ARCS ADVANCING SCIENCE IN AMERICA®
SAN DIEGO CHAPTER

ACHIEVEMENT REWARDS FOR COLLEGE SCIENTISTS

SCHOLARS' PROFILES
2023-2024

2023-2024 SCHOLARS

SAN DIEGO CHAPTER

The San Diego chapter of ARCS began in 1985 and has grown from the original four founders to more than 100 members today. As we enter our 39th anniversary year, we have made awards totaling over $12.3 million. Our academic partners are:

San Diego State University | Scripps Research

University of California San Diego | University of San Diego

ARCS Scholars are selected by their institutions in recognition of their achievements and their exceptional promise to contribute significantly to their fields. Basic requirements have been established by ARCS® Foundation, Inc.: Scholars must be U.S. citizens, have at least a 3.5 GPA, and they must be enrolled full-time in academic degree programs in science, technology, engineering, math, and biomedical research. Awards are $10,000, unrestricted, and renewable for three years. The San Diego chapter focuses on supporting students in doctoral programs, and the ARCS Scholars we have funded have a 98% graduation rate. For the 2023-2024 academic year, the San Diego ARCS chapter has awarded $500,000 to 50 Scholars.

SUMMARY

ARCS Foundation - San Diego Chapter 2023-2024 Scholars

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SAN DIEGO STATE UNIVERSITY

Jason Lajos Baer – Cell and Molecular Biology
Luisjesus Santiago Cruz - Biology
Jessica Eileen Griffin - Marine Ecology
Ryan Hanscom - Biology
Tiffany Luong – Cell and Molecular Biology
Adrian Xavier Rivera - Structural Engineering
Jovan San Martin – Chemistry
Ashley Valentina Schwartz – Applied Mathematics
Laura Gilman Sisk-Hackworth - Microbiology
Lilith Astete Vasquez – Environmental Engineering
Isabel Alejandra White – Mathematics Education

SCRIPPS RESEARCH

Roger Justice Fleischmann III - Immunology
Stephan Miguel Freeman - Chemistry
Brett Michael Garabedian - Molecular Medicine
Sergio Rodriguez Labra - Biomedical Sciences
Garrett Lee Lindsey – Chemical Biology
Colleen Ann Maillie – Structural and Computational Biology
Michaela Medina – Cell Biology
Kayla Elaine Nutsch – Biomedical Sciences
Caroline Rose Stanton - Biomedical Sciences

UNIVERSITY OF CALIFORNIA SAN DIEGO

Anela Kanani Akiona - Marine Biology
Krista Patrice Balto – Chemistry
Daniel Milgram Beaglehole – Computer Science and Engineering
Laura Lynn Becerra - Electrical and Computer Engineering
Alec Joseph Calac – Global Health
Austin Joseph Carter – Geosciences
Kellen James Cavagnero – Immunology and Microbiology
Minerva Contreras - Neurosciences
Wilfredo Gonzalez-Rivera - Bioinformatics and Systems Biology
Rayyan Mohammed Gorashi - Bioengineering
Sonya Renee Haupt - Biomedical Sciences
Nathaniel Max Klevit Hopkins - Computer Science and Engineering
Pratibha Jagannatha – Bioinformatics and Systems Biology
Wade Truman Johnson - Nanoengineering
Nishta Krishnan – Nanoengineering
Sahana Kuthyar – Ecology, Behavior and Evolution
Araz Majnoonian – Global Health
Joshua Manalo Mesfin – Bioengineering
Daniel Milshteyn - Chemistry and Biochemistry
Chiaki Isabela Santiago – Neurosciences
Consuelo Sauceda - Biomedical Sciences
Angus Blacklaw Thies - Marine Biology
Alisha Anish Ukani - Computer Science and Engineering
Alicia Ann Van Enoo – Neurosciences
Jessica Shen Yi Wan – Climate Sciences
Olivia Jade Weng - Computer Science and Engineering

UNIVERSITY OF SAN DIEGO

Andrea Marie Correia – Nursing
Oliver Mallillin Erece - Nursing
Jennie Miko Lee – Nursing
Tina Connie Smith - Nursing

SAN DIEGO STATE UNIVERSITY

The San Diego State University doctoral programs here are offered jointly with either the University of California Davis, the University of California San Diego, the University of California Irvine, or the University of California Riverside as noted in the Scholars' profiles.

JASON LAJOS BAER

San Diego State University / University of California San Diego

College of Sciences

Concentration: Cell and Molecular Biology

Specialization: Microbial Ecology

Donors: The Reuben H. Fleet Foundation

Despite major advances in our understanding of coral reefs, we have not yet had much success in rebuilding these highly diverse and inter- connected ecosystems. For his PhD, Jason is designing, building, and deploying midwater structures called Coral Reef Arks as tools to pick apart the complexity of coral reefs and to help restore them. Jason is using these "mini-reefs" to create pockets of reef biodiversity that can help reseed the surrounding areas, as well as in-water laboratories to study reef processes and test new conservation tools.

Degree: B.S. in Marine Science and Spanish Language, Eckerd College

Awards and Honors: SDSU Graduate Fellowship, 2022; CSU Program for Education and Research in Biotechnology Grant, 2022; NOAA Hollings Scholarship, 2015-2017; Eckerd College Ford Scholarship, 2015-2017

Publications, Papers, and Posters:

Baer, J.; Carilli, J.; Hartmann, A.; Haas, A.; Chadwick, B.; Hatay, M.; Rohwer, F.; et al. Coral Reef Arks: A Standardized In Situ Mesocosm and Potential Reef Restoration Tool. *Journal of Visualized Experiments: JoVE.* (in review, submitted September 2022)

Baer, J.; Carilli, J.; Hartmann, A.; Rohwer, F.; et al. Coral Reef Arks: An Innovative Solution for Coral Reef Mitigation. Oral presentation. *International Coral Reef Symposium*. July 2022.

Rojas, M.I.; Little, M.; **Baer, J.**; Rohwer, F. et al. Swabbing the Urban Environment - A Pipeline for Sampling and Detection of SARS-CoV-2 From Environmental Reservoirs. *Journal of Visualized Experiments: JoVE.* (170), DOI: 10.3791/62379.

Baer, J.; Pennington, P.; Woodley, C. The Effect of Anthropogenic Pollutants on ESA Coral Health. *NOAA National Ocean Service National Centers for Coastal Science Annual Report.* May 2017.

Current Research (expanded description). I have built and deployed several Coral Arks on Caribbean reefs in Curacao and Puerto Rico. We move threatened corals onto these Arks, alongside a diverse community of reef organisms (i.e., sponges, urchins, crabs) that support their health. By moving Arks off the seafloor, we provide the communities with higher flow and sunlight and avoid many of the challenges corals face on the seafloor, like sedimentation and hypoxia. We then study these communities as they grow to determine the optimal conditions needed to assemble and sustain healthy coral reefs and use this knowledge to design better restoration efforts.

Using Arks, we are discovering new ways that the reef's smallest players - viruses and microbes - impact the health of corals, the distribution of resources, and the relationships between organisms on reefs. On unhealthy reefs (i.e., many modern seafloor environments), microbes grow uncontrolled and disrupt the balance on the reef – causing disease, drawing down oxygen, and causing the death of many important reef creatures - a phenomenon called microbialization. Arks are a method to combat - and potentially reverse - microbialization for a coral reef community, providing the field with a tool to directly improve conservation and restoration outcomes.

Benefits to Science and Society: A major goal of the Coral Arks project is to directly benefit coastal communities by recruiting fish, creating dive sites for tourism, conserving local reef biodiversity, and helping reseed degraded areas, especially after hurricanes or ship groundings. Arks, as midwater structures, can be used to build reef communities in previously unworkable areas. In the process, Arks provide scientists with a new way to study entire coral reef communities as they grow and change on movable underwater laboratories isolated from the seafloor.

Personal Interests: As with research, I prefer to spend most of my time in the field. I am an avid SCUBA and freediver, surfer, photographer, camper, and national park aficionado.

ARCS Award: As a coral reef field scientist, much of my PhD work has been spent abroad in remote - and often, as a function of tourism, expensive - places. I am passionate about this work, and I am incredibly grateful to the ARCS Foundation for providing me with a safety net that enables me to continue pursuing fieldwork without concern of significant financial burden. The financial support of the ARCS Foundation will allow me to complete several more field expeditions to the islands of Curacao and Puerto Rico to continue to deploy and collect data on the artificial reef structures. I am proud to be a part of the ARCS community and, with the support of my ARCS mentors and peers, look forward to contributing important knowledge to both the scientific literature and to the field of coral restoration: a discipline in dire need.

LUISJESUS SANTIAGO CRUZ

San Diego State University / University of California San Diego

College of Sciences

Concentration: Biology

Specialization: Cancer Biology

Donor: Legler Benbough Foundation

Ovarian cancer progression is stimulated by signals in the tumor-microenvironment from surrounding cells and tissues. Luis is researching how an immune cell population known as macrophages in the tumor-microenvironment enhance ovarian cancer progression through the secretion of a protein known as TWEAK, which increases post-chemotherapy. He hopes to identify the macrophage population responsible for TWEAK secretion to find better cell-based immunotherapy by elucidating the role of specific immune cells in cancer progression and relapse.

Degrees: M.S. in Biotechnology and Bioinformatics with an Emphasis in Stem Cell Technology, California State University, Channel Islands; B.S. in Cell and Molecular Biology, California State Polytechnic University, Humboldt

Awards and Honors: Prebys Biomedical Research Endowed Scholarship, 2023; Rees-Stealy Research Foundation Fellowship, 2023; California Institute of Regenerative Medicine Predoctoral Fellowship, 2023; CSU Interdisciplinary Cancer Meeting (CSU-ICM) Poster Presentation Award, 2022

Publications, Papers, and Posters:

Cruz, L.S.; Stevenson, D.; Matthew, S.; Robinson, M.; House, C.D. Role of Macrophages in the Development of Ovarian Cancer Stem-like cells. Oral Presentation. *San Diego State University Biology Department Graduate Student Symposium,* San Diego, CA. May 2023.

Holmberg, R.; Robinson, M.; Gilbert, S. L.; Lujano-Olazaba, O.; Waters, J. A.; Kogan, E.; Lace, C.; Stevenson, D.; **Cruz, L.S.**; Alexander, L.; Lara, J.; Mu, E.; Camillo, J.; Bitler, B.; Huxford, T.; House, C.D. TWEAK–Fn14–RelB Signaling Cascade Promotes Stem Cell–like Features That Contribute to Post-Chemotherapy Ovarian Cancer Relapse. *Molecular Cancer Research* 2023, 21 (2), 170–186. DOI: 10.1158/1541-7786.MCR-22-0486.

Cruz, L.S.; Stevenson, D.; Matthew, S.; Robinson, M.; House, C.D. Role of Macrophages in the Development of Ovarian Cancer Stem-like cells. Poster Presentation. *CSU Interdisciplinary Cancer Meeting (CSU-ICM),* Northridge, CA. October 2022.

Current Research (expanded description): Ovarian cancer has a decreased overall survival rate once the cancer has spread. This is likely due to cancer stem-like cells (CSCs) which are a minority population of cells that can evade chemotherapy and persist following treatment. However, it's unclear how CSCs facilitate relapse and what role the tumor-microenvironment plays in this process. Our preliminary data has shown a secreted cytokine, tumor necrosis factor-like weak inducer of apoptosis (TWEAK), and its receptor Fn14 are overexpressed in ovarian tumors and increase during chemotherapy. We have shown TWEAK as a strong inducer of stem cell features and enhances survival of ovarian CSCs. Preliminary findings suggest the source of TWEAK in ovarian tumors is from infiltrating immune cells known as tumor associated macrophages (TAMs). Therefore, given that TAMs might be the main source of soluble TWEAK and that cytotoxic chemotherapy can enrich for different TAMs, my research goals will elucidate the role of TAMs in the production of TWEAK following chemotherapy, which supports CSCs and relapse potential. Understanding the regulation of TWEAK in ovarian cancer could lead to new therapeutic strategies for patients with high rates of relapse.

Benefits to Science and Society: Ovarian cancer is highly prone to relapse, where the recurrent tumors eventually stop responding to chemotherapy and the disease becomes incurable. This project is important because it will investigate the tumor-microenvironment in ovarian cancer and may reveal new players in this disease that could be targeted to prevent relapse, which could lead to new therapeutic strategies for patients with ovarian cancer as well as other cancers with high rates of relapse.

Personal Interests: I spend most of my free time relaxing at home and going on mental health walks.

ARCS Award: The ARCS Foundation award provides significant assistance. I will have the financial security to focus on my research project and continue developing skills to advance my career in biomedical research and academia. Biomedical research requires tremendous dedication to make applicable discoveries in cancer biology. While intriguing, the tumor microenvironment is highly complex, and as a result, my investigations require substantial optimization and animal modeling to provide significant discoveries that may be developed for patient treatment. Despite these challenges, the ARCS Foundation award has given me the encouragement and motivation to continue my research goals aiming to identify new pathways promoting cancer progression and relapse. By reducing my financial responsibilities and giving me access to a supportive network of colleagues and mentors, the ARCS Foundation award would aid me in my determination to become a self-sufficient and significant biomedical research scientist.

JESSICA EILEEN GRIFFIN

San Diego State University / University of California Davis

College of Sciences

Concentration: Marine Ecology

Specialization: Coastal Marine Community Dynamics

Donor: The Heller Foundation of San Diego

Jessica is a marine ecologist whose research focuses on the conservation of coastal marine ecosystems, which are rapidly degrading due to climate change, invasive species and pollution. Jessica studies California seagrass beds, which perform vitally important ecosystem services, such as carbon sequestration and providing habitat for many fishes and invertebrates. Jessica's research addresses three threats to eelgrass survival: invasive species, eutrophication (addition of nutrients to the water), and climate change, and will provide insight on how to preserve these ecosystems under the stress of global change.

Degrees: B.S. in Environmental Sciences, University of Connecticut; B.S. in Ecology and Evolutionary Biology, University of Connecticut

Awards and Honors: Dr. Susan Lynn Williams Memorial Graduate Award (2021); Council on Ocean Affairs, Science and Technology (COAST) Graduate Student Research Award (2021); NSF Graduate Research Fellowship (2019), Phi Beta Kappa Honor Society, Epsilon of Connecticut Chapter (2017)

Publication, Papers, and Posters:

Becker, D.M.; **Griffin, J.E.**; Miller, C. Identifying factors that contribute to positive and negative student experiences at field-based institutions. In *Women of the Wild: Challenging Gender Disparities at Field Stations and Marine Laboratories*. Lexington Books, 2022.

Griffin, J.E.; O'Malley, B.P.; Stockwell, J.D. The Freshwater Mysid Mysis Diluviana (Audzijonyte & Väinölä, 2005) (Mysida: Mysidae) Consumes Detritus in the Presence of Daphnia (Cladocera: Daphniidae). *Journal of Crustacean Biology.* 2020, 40(5), 520–525.

Griffin, J.E.; Park, G.; Dam, H.G. Relative Importance of Nitrogen Sources, Algal Alarm Cues and Grazer Exposure on Toxin Production of the Marine Dinoflagellate Alexandrium catenella. *Harmful Algae.* 2019, 84, 181–187.

Griffin, J.E.; Hovel, K.A. Interactive effects of habitat disturbance and Asian mussel invasion on seagrass infauna communities. Poster presentation. *Western Society of Naturalists*. October 2019. Ensenada, MX.

Current Research (expanded description): My dissertation focuses on species interactions in California eelgrass beds, and understanding how they are altered by anthropogenic forces like climate change and eutrophication. My work focuses on how environmental context affects bivalve-eelgrass interactions. Eelgrass coexists with bivalves such as clams and oysters, and previous studies have shown that sometimes, bivalves have positive effects on eelgrass, such as by increasing water clarity through filtration. However, sometimes bivalves harm eelgrass, such as by excreting toxic sulphides into the sediment. In my research, I investigate whether these disparities are due to environmental context, such as temperature or light conditions. Understanding how temperature and light affect eelgrass dynamics will be important as climate change alters temperature and eutrophication alters water clarity.

Benefits to Science and Society: Seagrasses form the basis of an important nursery habitat for many species and perform many ecosystem services, such as carbon sequestration. Due to human activities, seagrass beds are rapidly degrading, threatening the animal residents of these beds and the benefits they provide to society. My research addresses three threats to eelgrass survival: invasive species, eutrophication, and climate change, and will provide insight on how to preserve these vital ecosystems. When restored effectively, eelgrass beds may boost local fisheries and benefit California's economy.

Personal Interests: In my free time I enjoy hiking, traveling, and reading.

ARCS Award: I'm honored to receive this award and greatly appreciate the recognition of my work and potential as a marine ecologist. I am grateful for the opportunity to join a community of scholars motivated to produce excellent work that serves society's needs. Additionally, the support this award affords me helps me to focus on my graduate school work without undue financial stress. This award is helping to support me professionally and financially, and will surely contribute to my development as a scientist.

RYAN HANSCOM

San Diego State University / University of California Riverside

College of Sciences

Concentration: Biology

Specialization: Behavioral Ecology

Donors: Helga S. Moore/ARCS Foundation - San Diego Chapter

Ryan's research centers on understanding how temperature influences shortgrass prairie ecosystems. He utilizes advanced accelerometry technology to study the foraging behaviors of rattlesnakes and kangaroo rats, both keystone species in this habitat. By attaching miniaturized accelerometer devices to these animals, Ryan has developed machine learning models capable of detecting their activity, cryptic behaviors, and even foraging activities in the wild. This pioneering research offers valuable insights into how climate change may affect ecosystem stability and predator-prey interactions in the natural world, bridging the gap between theory and practical field experimentation.

Degrees: M.S. in Biology, Tennessee Technological University; B.S. in Biology, Framingham State University

Awards and Honors: Donald W. and Glennis A. Kaufman Research Award, American Society of Mammalogists, 2022; Charlotte Magnum Student Award, 2022-2023; William H.D. Meier Award, 2017; Undergraduate Student Research Award, 2017

Publications, Papers, and Posters:

Hanscom, R.J.; DeSantis, D.L.; Hill, J.L.; Marbach, T.; Sukumaran, J.; Tipton, A.; Thompson, M.; Higham, T.E.; Clark, R.W. How to Study a Predator that Only Eats a Few Meals a Year: High Frequency Accelerometry to Quantify Feeding Behaviours of Rattlesnakes (Crotalus spp.). *Animal Biotelemetry*. 2023, 11(1):20.

Hanscom, R.J.; Higham, T.E.; Ryan, D.; Clark, R.W. Ambush Hunting in Snakes: Behavior, Function, and Diversity. *Snakes: Morphology, Function, and Ecology.* Nova Science Publishers, 2023; pp 279–311.

Grisnik, M.; **Hanscom, R.J.**; New County Records for Reptiles and Amphibians from Middle Tennessee's Cumberland Plateau. *Herpetological Review*. 2020, 51:282–284.

Hanscom, R.J.; Dinkelacker, S.; McCall, A.; and Parlin, A. Demographic Traits of Freshwater Turtles in a Maritime Forest Habitat. *Herpetologica.* 2020, 76:12–21.

Current Research (expanded description): My research is centered on how anthropogenic-induced increases in global temperatures might affect the delicate balance of biotic interactions in our natural world. Broadly, I am deeply immersed in the specialization of behavioral ecology and predator-prey interactions, with my focus on the predator-prey relationships between Ord's Kangaroo Rats (Dipodomys ordii) and Prairie Rattlesnakes (Crotalus viridis). These two species coexist across a vast geographical range stretching from northern Mexico to southern Canada, encompassing a naturally occurring thermal gradient inherent to the short-grass prairie ecosystems they inhabit. This endothermic-ectothermic predator prey interaction are the types of interactions that are predicted to be most influenced by climate change. More specifically, I use cutting-edge natural history techniques, most prominently accelerometry, to investigate this system. By leveraging this innovative technology, I can determine moment-to-moment activities and cryptic behaviors exhibited by both kangaroo rats and rattlesnakes such as foraging and reproductive rates. Pioneering this method for the first time in snakes and on very small mammals such as kangaroo rats, provides a methodological framework for researchers in the future.

Benefits to Science and Society: My research is focused on the impacts of climate change on natural ecosystems and leverages new miniaturized technologies to understand more about organisms than we have in the past. Specifically, my research will provide context and predictions to governments, land managers, universities, conservation organizations, and more groups on how climate change will impact the ecosystem stability of prairie ecosystems across the Great Plains of North America.

Personal Interests: As with my research, I prefer to spend most of my time in the field whether that is hiking, fishing, kayaking, wildlife photography, birding, herping (searching for amphibians or reptiles), and more!

TIFFANY LUONG

San Diego State University / University of California San Diego

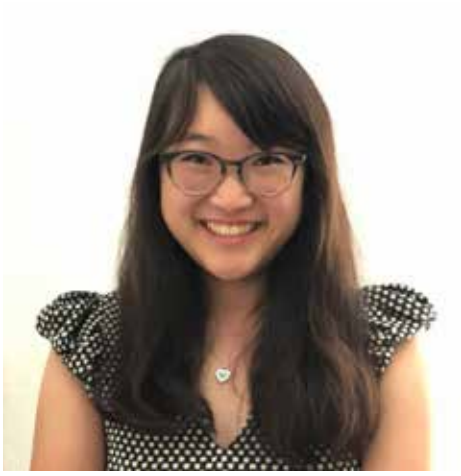
College of Sciences

Concentration: Cell and Molecular Biology

Specialization: Bacteriophage Biology

Donor: Hervey Family Fund

Antibiotic-resistant bacterial infections are a growing concern worldwide. Due to their ability to infect and kill bacteria, there has been renewed interest in harnessing bacteriophages, phages for short, as an alternative treatment against antibiotic resistance. Currently, phage therapy can only be approved by the FDA as an emergency treatment. During Tiffany's PhD research, she developed a method to produce high-quantity clinically safe phage preparations for personalized emergency patient treatment. Her ongoing research focuses on the rational design of phage combinations and their translational use.



Degree: B.S. in Molecular, Cell, and Developmental Biology, University of California Los Angeles

Awards and Honors: 25th Biennial Evergreen International Phage Meeting: Best Junior Oral Presentation 2023; SDSU Student Symposium S3: Dean's Award in Sciences 2023; San Diego State University Graduate Fellowship 2021-2022; ARCS Foundation Scholarship 2020–2023

Publications, Papers, and Posters:

Champagne-Jorgensen K.; **Luong T.**; Darby T.; Roach DR. Immunogenicity of Bacteriophages. Trends in Microbiology. 2023.

Luong, T.; Salabarria, A.C.; Roach, D.R. Phage therapy in the resistance era: Where Do We Stand and Where Are We Going? *Clinical Therapeutics.* 2020, 42(9):1659-1680

Luong, T.; Salabarria, A.; Edwards, R. A.; Roach, D.R. Standardized Bacteriophage Purification for Personalized Phage Therapy. *Nature Protocols.* 2020, 15 (9), 2867-2890

Mizuno, C.M.; **Luong, T.**; Cederstrom, R.; Krupovic, M.; Debarbieux, L.; and Roach, D.R. Isolation and Characterization of Bacteriophages That Infect Citrobacter rodentium, a Model Pathogen for Intestinal Diseases. *Viruses.* 2020, 12, 737

Current Research (expanded description): Bacteriophages, or "phages", are viruses that infect, replicate within, and kill bacteria. This makes them an attractive alternative antimicrobial for drug-resistant bacterial infections. For my thesis work, I am studying the tripartite interactions between phages, bacteria, and the mammalian host. Currently, how best to formulate phages therapeutically remains unknown. Thus, I am investigating phage-bacteria interactions to decipher how to mix different phages in combination (cocktail) and how to dose phage treatments against both planktonic (free-living) and biofilm (complex structure) modes of bacterial growth.

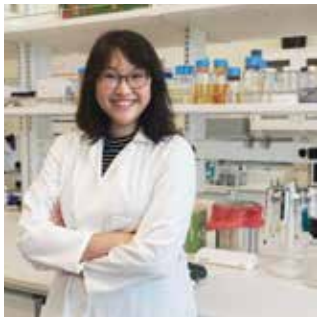
I have also had the exciting opportunity to participate in translational research during my PhD studies. In January 2022, I used a protocol that I established to produce and formulate a phage cocktail for compassionate use intravenous administration (Luong et al. *Nature Protocols* 2019). The patient, who had a multidrug resistant lung infection, received the phage cocktail and antibiotics and was discharged from the hospital. During treatment, we collected clinical samples to track changes in pathogen abundance, phage abundances, and total bacterial burden. I am currently continuing analysis of clinical metagenomes (collection of all the DNA reads in a sample including human, bacterial, viral, and archaeal) to analyze the effect of phages during treatment.

Benefits to Science and Society: During my PhD studies, I developed a method to standardize and purify phages to treat drug-resistant bacterial infections. This protocol is being used internationally and has been adapted for a phased clinical trial. For my ongoing work, I am studying the formulation, purification, and application of phages against Pseudomonas aeruginosa. Leveraging the individualism of phages to improve these aspects of clinical phage use will hopefully improve the consistency of therapeutic phage trial data. Approval of phage therapy as a mainstream therapeutic in the long-term can both prolong the shelf-life of existing antibiotics and improve the quality of care for patients with drug-resistant infections.

Personal Interests: Some of my interests and hobbies include piano, tabletop role-playing games, mahjong, food & travel, video games, science fiction and fantasy literature.

ARCS Award: ARCS has provided opportunities to network and develop new friendships with scholars and ARCS members. ARCS members have also challenged me to think critically about my thesis project at every step and to evaluate its broader impact. Most recently, hearing feedback and answering questions from ARCS members after presenting my research at an ARCS general meeting was particularly meaningful. My experience in the "Getting to Know You" ARCS program has also been a surprising boon during the school year. While my ARCS sponsor and I do chat about my research and goals, attending concerts and chatting about our favorite piano pieces has been a welcome break from the lab bench and a joyful part of my ARCS experience.

Being an ARCS scholar has also been an aspirational experience. The annual Scientist of the Year event was a highlight of my spring semester. Having the opportunity to attend the event in-person for the first time, I was enthralled by Dr. Margaret Leinen and the impact of her research. It was particularly inspiring to hear that during her time as a Dean at Scripps there has been an increase in female faculty at the institution. The wonderful, supportive community of women in ARCS has me aiming ever higher during my PhD and beyond.



ADRIAN XAVIER RIVERA

San Diego State University / University of California San Diego

College of Engineering

Concentration: Structural Engineering

Specialization: Non-Destructive Evaluation

Donor: Donald C. and Elizabeth M. Dickinson Foundation

Adrian's research is focused on analyzing manufacturing imperfections in aluminum honeycomb sandwich composites. The impact of this research will increase the understanding of how imperfections affect the material performance of aluminum honeycomb cores, allowing engineers to better identify potential failure of future aerospace structural designs. Furthermore, the tools used to construct finite element models of honeycomb core materials can be used for design optimization, improving the reliability and performance of fracture critical structures.

Degree: B.S. in Aerospace Engineering, San Diego State University

Awards and Honors: NASA Fellowship Activity. Aug 2018 - Aug 2021; ABRCMS Presentation Award. Parametric Shell Buckling Analysis Nov 2017; NASA NIFS Summer Internship. Finite Element/Shell Buckling May 2017

Publications, Papers, and Posters:

Rivera, A.X.; Venkataraman, S.; Hyonny, K.; Pineda, E.J.; Bergan, A. Characterization and Modeling of Cell Wall Imperfections in Aluminum Honeycomb Cores using X-ray CT Imaging. *AIAA Scitech.* 2021 Forum (p. 1620). DOI: https://doi.org/10.2514/6.2021-1620

Rivera, A.X.; Venkataraman, S.; Hyonny, K.; Pineda, E.J.; Bergan, A. Investigation of crushed response of aluminum honeycomb sandwich composites and sensitivity to manufacturing imperfections *NASA Glenn Research Symposium.* 2019

Current Research (expanded description): Aluminum honeycomb core is a common structural component that has been used in a range of industries from automotive to aerospace. The manufacturing of these aluminum honeycomb cores introduces a variety of imperfection sources that can change the expected performance of the initial design. The main focus of my research is to better understand the effect of imperfections on performance of honeycomb core parts. To accomplish this a detailed model was constructed using X-ray computed tomography. CT scans are routinely used to create 3D images of human body parts. In a similar fashion, a much stronger CT scan was used to capture the resultant honeycomb structure after the manufacture of a panel with the same specifications as one used on a space launch system. Results from this research has shown that the aluminum honeycomb core compression behavior is specific to the manufacturing signature within the given sample. Using models with the measured manufacturing imperfections yielded accurate predictions of compression stiffness as well as the compression strength when compared to the experimental results of specimens with the same manufacturing imperfections. This would indicate that to accurately predict the performance of aluminum honeycomb core measured imperfections must be considered.

Benefits to Science and Society: In the aerospace industry the margin of safety, which is the ratio of allowable strength and ultimate strength of the materials, is thin to reduce weight of the overall structure. My research is focused on identifying the imperfections that lead to the largest knockdown in performance and predict performance of a sandwich composite. Being able to predict performance of parts with manufacturing imperfections will help in gauging correctly the life span of critical components, potentially saving lives during commercial airline travel as well as manned space missions.

Personal Interests: I have played tennis at a collegiate level (Division III) and continue to play in local tournaments. I also have a great love of food, especially tacos.

ARCS Award: The current generation of minority students, because of the pandemic, face challenges that may make it more difficult than ever to finish higher education. My experiences as a student mentored in the supportive environment of SDSU and working with students through various outreach programs has resulted in my professional commitment to work to improve the representation and success of underrepresented students in graduate school. As an ARCS Scholar I wish to continue conducting outreach through the networking opportunities that the ARCS Foundation will provide.

JOVAN SAN MARTIN

San Diego State University / University of California San Diego

College of Sciences

Concentration: Chemistry

Specialization: Photocatalysis

Donor: Hervey Family Fund

Jovan specializes in the design of new perovskite photocatalysts that use renewable energy in the form of visible light to drive chemical reactions. Perovskites are effective materials for solar cell technology and Jovan aims to repurpose such materials for enhanced photochemical reactions. His work has shown perovskites can produce a variety of organic compounds that can be the scaffold for future pharmaceutical drugs. Since perovskites are cheap, quick to produce, recyclable, and powered by renewable energy, Jovan's work can lower both the economic and environmental cost of producing pharmaceutical drugs.

Degree: B.S. in Chemistry, San Diego State University

Awards and Honors: JDP Student Research Award, 2022; Inorganic Chemistry Student Research Award, 2022; University Graduate Fellowship, 2021-2023; Master's Research Scholarship 2020

Publications, Papers, and Posters:

San Martin, J. Diastereomeric Effect within Lead Halide Perovskite Nanocrystals. Oral presentation at the *2023 Fall National ACS Meeting.* San Francisco, CA.

Mishra, K.; Guyon, D.; **San Martin, J.**; Yan, Y. Chiral Perovskite Nanocrystals for Asymmetric Reactions: A Highly Enantioselective Strategy for Photocatalytic Synthesis of N-C Axially Chiral Heterocycles. *Journal of the American Chemical Society*. 2023, 145 (31), 17242–17252.

San Martin, J. Lead-Halide Perovskites for Photocatalytic Organic Transformations. Poster presentation at *2022 CHOISE 2 Kick Off Meeting.* Boulder, CO.

San Martin, J.; Dang, N.; Raulerson, E.; Beard, M. C.; Hartenberger, J.; Yan, Y. Perovskite Photocatalytic CO2 Reduction or Photoredox Organic Transformation? *Angewandte Chemie International Edition*. 2022, 61 (39), e202205572.

San Martin, J. CsPbBr3 Perovskite Microcrystals for Photocatalytic CO2 Reduction Studies. Oral presentation at *2022 Spring National ACS Meeting.* San Diego, CA.

Current Research (expanded description): The goal of my research is to exploit the tunability of metal halide perovskites towards highly selective and efficient organic photocatalysis. Specifically, I am interested in seeing how transition metal tuning, heterojunction engineering, and chiral ligand modification can modify perovskite's properties toward a variety of organic reactions. My published results have shown that careful tuning of perovskite with a transition metal, copper, can allow perovskite to form nitrogen-nitrogen bonds in diamines via combining photocatalysis with transition metal catalysis. I plan on further investigating the role of transition metal tuning with perovskites by tuning with manganese to take advantage of the magnetic properties of manganese. In the presence of an external magnetic field, such a modification is expected to further enhance the reactions rates of various photocatalytic properties. I also explore various methods of enhancing the stability of perovskites in polar solvents by heterojunction engineering via metal organic framework modifications and zwitterion ligand exchange. One final pillar of my research is synthesizing new forms of chiral perovskites with the end goal of designing a stable chiral perovskite that can proceed in asymmetric photoredox organic transformations, such as asymmetric alpha-alkylation of aldehydes.

Benefits to Science and Society: The goal of my thesis work is to repurpose powerful solar cell materials, perovskites, for enhanced photocatalysis in organic synthesis, such as pharmaceutical drug synthesis. Currently perovskites are underexplored with respect to organic chemical transformations, however, the low cost, ease of synthesis, and recyclability of perovskites make them excellent candidates for photocatalysis. Since such materials are powered by visible light, such as renewable solar energy, perovskites can reduce the cost of synthesizing drugs with a reduced carbon footprint.

Personal Interests: In my free time I like to exercise, write poetry, and make my friends laugh.

ARCS Award: I am humbled and honored to be selected for such a prestigious and highly competitive award. The ARCS Foundation award marks my growth as a young scientist and helps remind me that I am indeed making great progress in my research studies and have grown tremendously over the past years in several ways. I am very grateful to the ARCS Foundation for recognizing my work and giving me the opportunity to further focus more of my efforts towards my research projects while also serving as an example to my students from underrepresented backgrounds. It is my pleasure to join the ARCS community and I look forward to making new discoveries and giving back to the scientific community.

ASHLEY VALENTINA SCHWARTZ

San Diego State University / University of California Irvine

College of Sciences

Concentration: Computational Science

Specialization: Computational Toxicology

Donor: Robin Luby

Environmental contaminants that pose a threat to the health and well-being of society are continually emerging, and high-throughput biological testing helps to characterize that risk. Ashley's research focuses on building mathematical and computational toxicology models to improve chemical safety assessment by leveraging available public data and creating an alternative to extensive animal testing. Ultimately, she hopes to shed light on the way environmental pollutant exposures can impact our health and development.

Degree: B.S. in Applied Mathematics, San Diego State University

Awards and Honors: Computational Science Research Center ACSESS Director's Award, 2023; Best Trainee Abstract Award, Biological Modeling at SOT 2023; Computational Science Research Center ACSESS Director's Award, 2023; Best Trainee Abstract Award, Biological Modeling at SOT 2023; ACM Computational and Data Science Fellowship, 2020; NSF S-STEM Academic Support & Scholarships for Interdisciplinary Computational Scientists, 2020.

Publications, Papers, and Posters:

Schwartz, A.V.; Sant, K.E.; George, U.Z. Development of a Dynamic Network Model to Identify Temporal Patterns of Structural Malformations in Zebrafish Embryos Exposed to a Model Toxicant, Tris(4-chlorophenyl) methanol. *Journal of Xenobiotics.* 2023, 12(2), 284-297. DOI: 10.3390/jox13020021.

Schwartz, A.V.; Lee, A.N.; Theilmann, R.J.; George, U.Z. Spatial Heterogeneity of Excess Lung Fluid in Cystic Fibrosis: Generalized, Localized Diffuse, and Localized Presentations. *Appl. Sci.* 2022, 12, 10647. DOI: 10.3390/app122010647.

Schwartz, A.V.; Sant, K.E.; Navarrete, J.; George, U.Z. Mathematical Modeling of the Interaction between Yolk Utilization and Fish Growth in Zebrafish, Danio Rerio. *Development.* 2021, 148 (9) DOI: 10.1242/dev.193508.

Horkowitz, A.P.; **Schwartz, A.V.**; Alvarez, C.A.; Herrera, E.B.; Thoman, M.L.; Chatfield, D.A.; Osborn, K.G.; Feuer, R.; George, U.Z.; Phillips, J.A. Acetylcholine Regulates Pulmonary Pathology during Viral Infection and Recovery. *ImmunoTargets and Therapy.* 2020, Volume 9, 333–350. DOI: 10.2147/ITT.S279228.

Current Research (expanded description): Toxic substances make their way into our environment, food, and bodies every day. My work characterizes the toxicity of these chemicals during embryonic development as any perturbations, whether structurally or molecularly, can potentially predispose an individual to disease later in life. I develop computational and mathematical models to answer complex questions about system dynamics, biological processes, and molecular response.

Currently, my work is centered around using multilayer network models to investigate the molecular response to a large set of environmental pollutants. Individual studies typically assess a single chemical in the lab, but due to resources, time, and means it is less common for a study to contextualize those changes to mixtures, metabolites, and other chemicals. I combine these embryonic toxicity transcriptomic data sets using developed high-performance computing bioinformatics pipelines and further analyze the data using network machine learning models.

Applying computational power to centralize publicly available data increases the knowledge we can gain from toxicity assessment studies. I am working to build a well-informed machine learning model that can predict the molecular response to a new environmental pollutant in silico, minimizing the need for repeated in vivo testing.

Benefits to Science and Society: The benefits of computational power are evident in the current data-driven world we live in. I am bringing computational and mathematical expertise to the developmental toxicology space, creating high-throughput frameworks for toxicity assessment. I specifically aim to increase data analysis speed using high-performance computing and reach novel predictions using artificial intelligence/machine learning, differential equation modeling, and network analysis. The tools developed elucidate the negative impacts many environmental pollutants have on the health and well-being of society.

Personal Interests: In my free time, I enjoy walking and hiking with my dog, traveling to new places, and reading.

ARCS Award: I am honored to be an ARCS scholar and an ARCS Foundation member. Throughout my educational career, I have been greatly impacted by the people I am lucky enough to surround myself with. The amount I have learned about educational and career opportunities through these connections has greatly impacted the trajectory of my future. The ARCS Foundation award represents a door to a new set of incredible scientists from whom I will learn and grow. It is especially exciting for me, coming from a predominately male field, to be a part of a woman-centered STEM organization. The generosity of financial support enables me to spend more time on my research endeavors and share my work at conferences around the country. This award allows me to catapult my career to a new height, for which I am extremely grateful.

LAURA GILMAN SISK-HACKWORTH

San Diego State University / University of California San Diego

College of Sciences

Concentration: Microbiology

Specialization: Microbiome-Host Interactions

Donor: Ellen Browning Scripps Foundation

You probably remember puberty as a time of immense and confusing changes, but you might not know that the microbes in your gut were changing with you. Laura's research focuses on how the physiological changes that we experience during puberty, like soaring hormone levels and metabolic shifts, affect which microbes live in our gut and what they do there. Knowing how puberty shapes the gut microbiome will help us better understand microbiome-related diseases that emerge during puberty, like polycystic ovary syndrome and type I diabetes.

Degree: B.S. in Biological Sciences, California Polytechnic State University, San Luis Obispo

Awards and Honors: 2021-2024 National Institutes of Health F31 Fellowship (Perfect Score); ARCS Foundation Scholar, 2021-2024; SDSU CORE Fellowship, 2023; CMB Joint Doctoral Program Outstanding Research Achievement Award, 2020-2021

Publications, Papers, and Posters:

Sisk-Hackworth, L.; Kelley, S.T.; Thackray, V.G. Sex, Puberty, and the Gut Microbiome. *Reproduction*. 2023, 4;165(2).

Sisk-Hackworth, L.; Ortiz-Velez, A.; Reed, M.B.; Kelley, S. T. Compositional Data Analysis of Periodontal Disease Microbial Communities. *Frontiers in Microbiology.* 2021, 12 (846).

Sisk-Hackworth, L.; Kelley, S.T. An Application of Compositional Data Analysis to Multiomic Time-Series Data. *NAR Genomics and Bioinformatics.* 2020, 2 (4).

McGhee, J.J.; Rawson, N.; Bailey, B.A.; Fernandez-Guerra, A.; **Sisk-Hackworth, L.**; Kelley, S.T. Meta-SourceTracker: application of Bayesian source tracking to shotgun metagenomics. *PeerJ.* 2020, 8, e8783.

Current Research (expanded description): During puberty, sex-specific differences in the gut microbiome emerge and last into adulthood. I performed a preliminary study comparing the gut microbes and gut metabolites (a measure of microbial function) in pre-pubertal and post-pubertal healthy female mice. I found that even though mice are colonized by different microbes during puberty, puberty is associated with the development of specific microbial functions. To determine which microbes and functions of the gut microbiome change due to puberty in a sex-specific manner, I used the hypogonadotropic mouse model, in which mutant mice lack a functional reproductive axis and do not go through puberty. I have showed that the reproductive axis leads to sexual differentiation of the development of the gut microbiome along the intestinal tract, but that the effect of the reproductive axis is specific to each intestinal section. This indicates that the effect of sex steroids and reproductive status on development of microbiome-related diseases needs to be further investigated. Furthermore, my research indicates that when developing microbiome-based treatments for diseases, host sex and hormonal status should be considered. Next, I will analyze how microbial functions within the gut shift during puberty and how the reproductive axis affects that shift.

Benefits to Science and Society: Puberty is a critical period in human development with lasting health impacts. Links between puberty and microbiome changes during adolescence are important to understand, as some diseases that emerge during puberty, such as polycystic ovary syndrome, type I diabetes, and irritable bowel disease, are strongly linked to the gut microbiome. My research will unravel the links between puberty and the gut microbiome, opening the door for developing microbiome interventions and therapeutics that could treat or prevent these types of diseases.

Personal Interests: I spend my free time reading novels, playing piano, and hiking around San Diego.

ARCS Award: I am honored by the support from the ARCS Foundation. Not only is recognition from such a prestigious organization gratifying, but the opportunities to share my research with the membership and meet so many enthusiastic supporters of science are invaluable. The financial aspect of the award relieves a significant amount of stress and allows me to put more of my focus towards my research and community outreach. I cannot overstate how thankful I am for the ARCS Foundation's support of my scientific and career success.

LILITH ASTETE VASQUEZ

San Diego State University / University of California San Diego

College of Engineering

Concentration: Environmental Engineering

Specialization: Sustainable Onsite Sanitation Systems and Contaminants of Emerging Concern

Donor: Hervey Family Fund

Across the globe, 3.6 billion people living in vulnerable and disadvantaged communities lack access to improved facilities for the storage and treatment of fecal waste. To reduce these numbers, sanitation systems that are economically sustainable while minimizing impacts to human and environmental health must be further explored. Lilith's research contributes to these efforts through the study of fundamental processes and translatable real-world technologies for sanitation applications ranging from short-term encampments of unhoused or displaced people to long-term use at the household scale. Lilith also studies removal of pharmaceuticals from onsite sanitation systems and antibiotic resistant bacteria and genes in decentralized wastewater in Brazil.

Degree: B.S. in Environmental Engineering, San Diego State University

Awards and Honors: National Science Foundation Graduate Research Fellowship, 2021-present; SDSU Student Symposium Women in Engineering Award, 2023; SDSU ZIP Launchpad Chinyeh Hostler Social Venture Challenge Student Pitch Competition 2nd Place, 2023; SDSU University Graduate Fellowship, 2019-2021 & 2023-2025

Publications, Papers, and Posters:

Astete Vasquez, L.; Mladenov,N. Effect of Modified Waste Introduction Methods Over Short-term and Long-term Use of Onsite Sanitation Systems. *Scientific Reports.* 2023, Special Issue on "Water and Wastewater Technologies."

Astete Vasquez, L.; Calábria de Araújo, J., Mladenov, N. Response of Antibiotic Resistant Bacteria During Anammox Treatment of Pretreated Municipal Wastewater and Landfill Leachate. *Association of Environmental Health and Safety 33rd Annual International West Coast Conference on Soil, Water, Energy and Air*. 2023.

Rivera E.; Mladenov N.*; **Astete Vasquez, L.**; McKenzie, G.; Gonzalez,V. Low Maintenance Anammox Enrichment and Nitrogen Removal with an Anaerobic Baffled Reactor. *Bioresource Technology*. 2022, Special Issue on "Advanced Biological Technologies for Removal and Recovery of Reactive Nitrogen from Wastewaters."

Current Research (expanded description): According to United Nations surveys, in 2020 3.6 billion people lacked access to 'improved' sanitation systems, which are designed to provide adequate barriers protecting users from fecal pathogens and sufficient removal of harmful contaminants prior to environmental release. The auto-constructed, rudimentary facilities in current use where funds and resources are limited are a known source of pollution and fail to incorporate features that are desirable to their users. My research focuses on sanitation systems designed for practical use in regions facing water scarcity, lack of sewage infrastructure, and socioeconomic constraints. For two years, I compared changes to contents of simulated self-flushing toilets in response to repeat introduction of non-dilute waste under four different introduction schemes, each with unique scientific and cultural relevance. The results of this work inspired a device that I have worked toward patenting and exploring a business startup to bring it to commercialization. I have recently initiated a pilot study on septic tanks in San Diego County to prove that my device works during real-world application to extend the use of septic systems and reduce the required frequency of tank pumping.

Benefits to Science and Society: This work extends scientific knowledge on fundamental processes occurring within onsite sanitation systems and can contribute to their improvement through simple design modifications. Access to adequate sanitation is a human right that is pertinent to public and environmental health and has been shown to increase community productivity. Construction of new systems or retrofitting of existing ones could also provide economic benefit through employment of local experts for supplies and labor.

Personal Interests: I enjoy learning to cook international foods and speak new languages and collecting random (seemingly useless until they're not!) facts.

ARCS Award: Based on the achievements of previous awardees, the ARCS Foundation Scholarship seems to be an indicator for success. I am honored to have myself and my work as a researcher recognized as being at the same level of importance as other members of my cohort, and I look forward to sharing the results of our collective advancements in science and engineering.

ISABEL ALEJANDRA WHITE

San Diego State University / University of California San Diego

College of Sciences

Concentration: Mathematics Education

Specialization: Algebraic Reasoning and Technology

Donor: The Reuben H. Fleet Foundation

Algebra serves as a gatekeeper to more advanced courses in secondary mathematics. At the same time, mathematics education has experienced rapid changes since the COVID-19 pandemic, highlighting a need for novel digital technology. Isabel is working on a research project that seeks to understand how students learn complex algebra topics through the using instructional mathematics videos featuring students in dialogue. Through her research, she aims to better equip educators support students' algebra learning in a digital world.

Degrees: M.A. in Mathematics, San Diego State University; B.A. in Mathematics, Rice University

Awards and Honors: University Graduate Fellowship Recipient, Fall 2022; UCSD Travel Award through the Graduate Professional Student Association, Spring 2023; Elliott Family Fund Scholarship, Spring 2019; SDSU Center for Teaching and Learning Certificate in Evidence-Based Teaching for Graduate Students, Fall 2018

Publications, Papers, and Posters:

White, I.; Foster, M.; Lobato, J. Making Sense of Algebraic Expressions in Context. *Mathematics Teacher: Learning and Teaching.* 2023. PK-12, 116(8). https://doi.org/10.5951/MTLT.2022.0196.

Tenney, K.; Stringer, B. P.; LaTona-Tequida, T.; **White, I.** Conceptualizations and Limitations of STEM Literacy Across Learning Theories. *Journal of Microbiology and Biology Education*. 2023, 24(1), 1-5. https://doi.org/10.1128/jmbe.00168-22.

Reinholz, D. L.; Stone-Johnstone, A.; **White, I.;** Sianez Jr, L. M.; Shah, N. A Pandemic Crash Course: Learning to Teach Equitably in Synchronous Online Classes. *CBE—Life Sciences Education.* 2020, 19(4), ar60. https://doi.org/10.1187/cbe.20-06-0126.

Reinholz, D. L.; **White, I**.; Andrews, T. Change Theory in STEM Higher Education: A Systematic Review. *International Journal of STEM Education*. 2021, 8(1), 1-22. https://doi.org/10.1186/s40594-021-00291-2.

Current Research (expanded description): I am investigating how high school students may develop ways of mathematical reasoning about algebra topics as they engage with instructional mathematics videos featuring dialogue. The videos used in the study are conceptually oriented and feature student-student interactions, distinguishing them from the dominant model of lecture-style mathematics videos such as the Khan Academy. The study has three main aims: to explore how students learn algebra from engaging with the video tool, how the video tool mediates their learning, and how the tool may be used for a pedagogical purpose in a classroom setting.

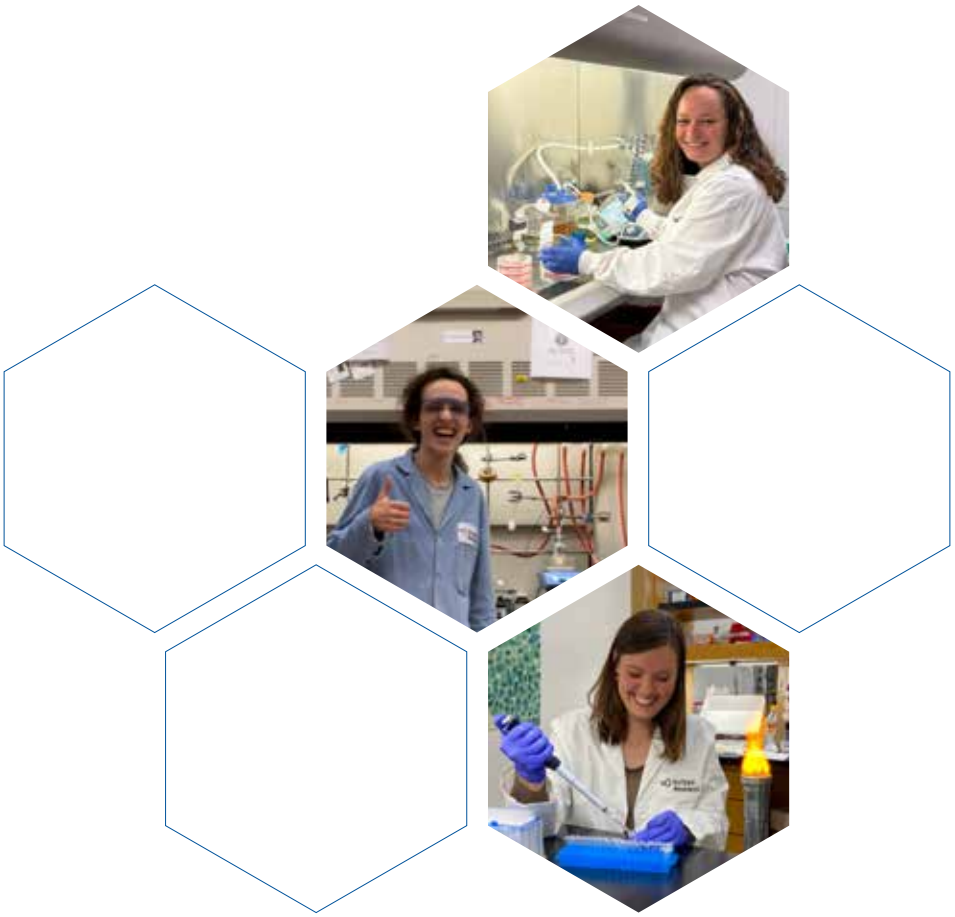
The study follows a classroom teaching experiment methodology. A group of eight students will work together, facilitated by the teacher-researcher (myself). With the first research question, I will document the emergence of ways of reasoning that become expected in the classroom community over the course of ten one-hour sessions. With the second research question, I will report on ways in which the video tool is mediating the ways of reasoning that emerged. Lastly,with the third research question, I will investigate the teaching practices that were involved with the management of the video tool. With this question, I will document the ways in which the teacher-researcher orchestrated the use of the videos to support students' reasoning.

Benefits to Science and Society: Understanding the impact of dialogic mathematics videos in the classroom can promote the design of similar instructional videos that foster critical thinking and collaboration. Additionally, this research can contribute to the improvement of algebra education. By documenting students' algebra learning from a concept-oriented digital tool, educators will be better equipped to support their students in learning algebra topics in a digital world. This benefits a broader and more diverse population of learners, including those with limited access to educational resources.

Personal Interests: I enjoy singing in choir, Latin dancing, and going to the movies.

ARCS Award: Being named on ARCS Scholars is such an honor both professionally and financially.


Scripps
Research



ROGER JUSTICE FLEISCHMANN III

Scripps Research

Skaggs Graduate School of Chemical and Biological Sciences

Concentration: Immunology

Specialization: T Cell Biology

Donors: The Paul Bechtner Foundation /ARCS Foundation - San Diego Chapter

Justice investigates the factors which provoke and inhibit immune rejection of cellular transplants. His research revolves around genetically engineering donor-derived white blood cells to eliminate tumors, while also designing them to safely persist inside the patient. By studying the biology of these cells, Justice will produce novel strategies to transplant various types of cells, reduce the economic burden of cell therapy, and improve access to cell therapy.

Degree: B.S. in Biology, Boston College

Awards and Honors: U.S. Department of Energy, Ames National Laboratory, SULI Research Fellow, 2015

Current Research (expanded description): T cell stimulation requires three signals: 1) ligation of the T cell receptor (TCR) by a major histone compatibility (MHC) class I molecule; 2) ligation of a costimulatory surface molecule; and 3) cytokine signaling. Bispecific T cell engagers are a flavor of immunotherapy which stimulates T cells to destroy cancer cells by recreating signals 1 and 3, albeit at supraphysiological levels. These therapeutics have proved to be successful in clinical trials and six have been approved by the FDA. Still, patients experience severe adverse effects. In my research, I have identified a specific amino acid in the therapeutic which, when mutated, dramatically reduces T cell stimulation. This reduction is likely to provide a safer and more durable anti-cancer immune response because the T cells experience less exhaustion and release normal levels of cytokines, rather than harmful levels. Additionally, I am investigating modifications which will engage signal

two. After screening over 150 different costimulatory ligands, we have identified the novel ligand, CD40L, and shown efficacy in transgenic mouse models. I am currently elucidating how engaging this modality affects T cell biology, which also deepens our understanding of CD40L's impact on T cell function.

Benefits to Science and Society: Bispecific T cell engaging antibodies have shown remarkable success in treating cancer and there are now six products on the market. However, these therapies are limited in scope by their supra-physiological activation of the immune system, lack of success in solid tumors, and neglect in stimulating T cells by all three canonical signals. A novel trispecific T cell engaging antibody circumnavigates these issues by providing physiological T cell activation, efficacy against solid tumors, and ligation of a costimulatory ligand. This research has the potential to be translated into effective, durable, and safe clinical therapies.

Personal Interests: I enjoy surfing, rock climbing, gardening, dance, DEI and STEM education, contemporary art, traveling, cooking, Dungeons and Dragons, interior design, and my dog.

ARCS Award: The ARCS Foundation is an opportunity for me to expand my horizons. It brings me in contact with unique scientists, enthusiastic leaders, and groundbreaking research. I am excited to accept the award and participate in this community.

STEPHAN MIGUEL FREEMAN

Scripps Research

Skaggs Graduate School of Chemical and Biological Sciences

Concentration: Chemistry

Specialization: Organic Chemistry

Donors: Drs. Mara and Larry Ybarrondo/ARCS Foundation - San Diego Chapter

The natural products found in the bark of the Galbulimima tree are rich with medicinal potential. Extracts of this bark are employed in traditional Papuan medicine for their pain-relieving and hallucinogenic properties. Stephan is undertaking a chemical synthesis of some Galbulimima alkaloids that broadly induce depressant effects in mammals. Evidence suggests that Galbulimima alkaloids target central nervous system receptors; this synthesis will enable a rigorous investigation into these alkaloids' biochemical target(s) and may uncover a valuable collection of central nervous system-active natural products.

Degree: B.S. in Chemistry, Xavier University

Awards and Honors: Xavier University Student Researcher of the Year, 2021; Borcer Fund Research Fellowship, 2019.

Publications, Papers, and Posters:

Shevick, S.L.; **Freeman, S.M.**; Tong, G.; Russo, R.J.; Bohn, L.M.; Shenvi, R. A. Asymmetric Syntheses of (+)- and (-)-Collybolide Enable Reevaluation of kappa-Opioid Receptor Agonism. *ACS Central Science.* 2022, 8, 7, 948-954.

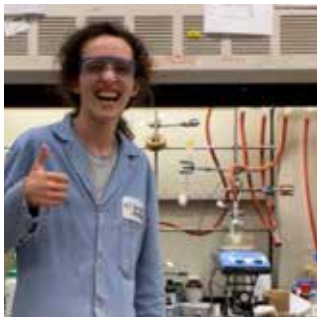
Shevick, S.L.; **Freeman, S.M.;** Tong, G.; Russo, R.J.; Bohn, L.M.; Shenvi, R. A. Asymmetric Syntheses of (+)- and (-)-Collybolide Enable Reevaluation of kappa-Opioid Receptor Agonism. Presented at *National Organic Symposium*, San Diego, CA, June 2022.

Current Research (expanded description): In vivo assays of Galbulimima alkaloids between 1950 and 1970 identified numerous alkaloids possessing a CNS-active phenotype in mammals. However, given the extremely low (<0.5%) abundance of alkaloids in Galbulimima bark, only the most prevalent alkaloid, himbacine, could be assigned a receptor target: 4 nM antagonism of the muscarinic acetylcholine receptor M2. Other Galbulimima alkaloids induce diverse effects in vivo, but further investigation of their properties and identification of their receptor targets have been significantly impeded by a scarce natural supply of Galbulimima alkaloids. Synthetic access to these alkaloids would greatly enable a rigorous biochemical investigation. My goal is to accomplish a synthesis of the "class II" alkaloids that comprise over half of all Galbulimima alkaloids isolated to date. These class II alkaloids bear additional oxidations relative to other family members that frustrates attempts to synthesize them by direct analogy to prior work.

Benefits to Science and Society: Himbacine, the most abundant Galbulimima alkaloid, was subject to a medicinal chemistry campaign by Schering-Plough that culminated in the discovery of an FDA approved PAR-1 antagonist, vorapaxar. We believe that even more Galbulimima alkaloids have untapped medicinal potential; our syntheses may yield numerous starting points for medicinal chemistry through the discovery of new CNS-active scaffolds.

Personal Interests: I love the piano! When I'm not at the lab, I'm working on Ravel's *Gaspard de la nuit* – one of my favorite pieces ever written.

ARCS Award: I learned much of what I know about making molecules from my mentor in my first year of graduate school – and former ARCS scholar – Sophie Shevick. It's a true honor for me to be included alongside her and the other incredible scientists of ARCS. I'm grateful for the opportunity to learn from this community of scientists, and for the support that will help me advance my study of chemistry.



BRETT MICHAEL GARABEDIAN

Scripps Research

Skaggs Graduate School of Chemical and Biological Sciences

Concentration: Molecular Medicine

Specialization: Glycoimmunology

Donor: The Reuben H. Fleet Foundation

Brett uses chemistry and protein engineering to empower our immune system against diseases including chronic infection and cancer. His work focuses on the dense layer of sugars (glycans) that populate the cell-cell synapses formed between white blood cells and diseased cells. By tailoring these interactions using chemical biology tools, Brett is developing novel therapies of disease that will advance the field of "glycoimmunology" and broadly benefit patient outcomes in the clinic.

Degrees: M.S. in Chemistry, University of Basel; B.S. in Chemical Biology, University of California Berkeley; A.A. in Biological Sciences, Santiago Canyon College; G.G. in Diaonds and Colored Stones, Gemological Institute of America, Carlsbad, CA

Awards and Honors: ARCS Scholar, 2023; TL1 Training Grant, 2022; Alfred Werner Scholar at the University of Basel, 2017; SURF Rose Hills Fellow at The University of California at Berkeley, 2015

Publications, Papers, and Posters:

Garabedian, B.M.; Meadows, C.W.; Mingardon, F.; Guenther, J.M.; de Rond, T., Abourjeily, R.; Lee, T.S. An Automated Workflow to Screen Alkene Reductases Using High-Throughput Thin Layer Chromatography. *Biotechnol Biofuels.* 13, 184. 2020. PubMed PMID: 33292503.

Garabedian, B.M.; Rebelein, J.G.; Lohzkin, B.; Ward, T.R. Artificial Metalloenzyme Directed Prodrug Activation on Tumor Cells. in *CHIMIA.* Vol. 73. 2019.

Heinisch, T.; Schwizer, F.; **Garabedian, B.M.**; Csibra, E.; Jeschek, M.; Vallapurackal, J.; Pinheiro, V.B.; Marliere, P.; Panke, S; Ward, T.R. E. Coli Surface Display of Streptavidin for Directed Evolution of an Allylic Deallylase. *Chem Sci*. 2018, 9, 5383-5388. PubMed PMID: 30079176.

Meadows, C.W.; Mingardon, F.; **Garabedian, B.M.**; Baidoo, E.E.K.; Benites, V.T.; Rodrigues, A.V.; Abourjeily, R.; Chanal, A.; Lee, T.S. Discovery of Novel Geranylgeranyl Reductases and Characterization of Their Substrate Promiscuity. *Biotechnol Biofuels.* 2018, 11, 340. PubMed PMID: 30607175.

Current Research (expanded description): The surface of all healthy cells is covered in "don't eat me" signals encoded as densely packed carbohydrates called glycans. These information-rich glycans are decoded by immune receptors on white blood cells called inhibitory Siglecs that together, constitute "glyco-immune checkpoints" that prevent killing of healthy cells. A nefarious ploy of cancer cells is their ability to hijack this carbohydrate camouflage and evade the immune response. Encouraging studies suggest that by targeting glyco-immune checkpoints, it is possible to reinvigorate the immune response in a manner resembling Nobel Prize-winning therapies targeting the immune checkpoints PD1 and CTLA-4. My research as an ARCS Scholar will expand on this strategy to chemically remodel the immunological synapse and elicit a potent immune response that could benefit patients beyond current best therapies.

Benefits to Science and Society: We live in a time where first-in-class chemical tools are coming online faster than ever, and we are using them to elucidate the importance of glycans in health and disease. My project seeks to define the mechanisms underpinning glyco-immune checkpoints and in doing so, contribute knowledge to the emerging fields of Glycobiology and Glycoimmunology. I am excited by the wealth of therapeutic opportunities within this space, and by their potential to benefit patients afflicted by incurable diseases like cancer.

Personal Interests: SciComm, cooking, guitar, gardening, and prospecting for minerals.

ARCS Award: My beautiful wife and I are recently welcomed our baby boy into the world. The ARCS Foundation award provides us the financial freedom to focus on family and plan for a future beyond PhD studies.

SERGIO RODRIGUEZ LABRA

Scripps Research

Skaggs Graduate School of Chemical and Biological Sciences

Concentration: Biomedical Sciences

Specialization: Translational Neuroscience

Donor: Toby Eisenberg

Alzheimer's disease is the most common form of dementia worldwide and is still not well understood. Sergio's research seeks to address a critical need in the field, that is, the lack of adequate pre-clinical models. By innovating stem cell-derived human brain organoid-based models to better reproduce the progression of Alzheimer's disease, Sergio's efforts focus on uncovering new disease mechanisms and more reliably testing promising new drugs in development as potential treatments for the disease.

Degrees: M.S. in Biotechnology, University of Pennsylvania; B.S.E. in Chemical and Biomolecular Engineering, University of Pennsylvania

Awards and Honors: NIH Clinical & Translational Science TL1 training grant 2021-2023; Dean's Fellowship, Scripps Research 2018; Graduate Research Fellowship Program Honorable Mention, National Science Foundation 2018; Outstanding Young Investigator Award, Alzheimer's Drug Discovery Foundation 2018.

Publications, Papers, and Posters:

Yoon, L.; Botham, R.C.; Verhelle, A.; Cole, C.; Tan, E.P.; Wu, Y.; Sanz-Martinez, P.; Xu, J.; Cuoco, C.A.; Chou, C.C.; **Labra, S. R.** mTOR Inhibitor-independent Autophagy Activator Ameliorates Cellular Tauopathy and Prionopathy Neurodegeneration Phenotypes. *bioRxiv*. 2022.

Labra S.R.; Cole C.; Ghatak S.; Piña-Sanz J.; Cedeño C.; Dolatabadi N.; Yoon L.; Lin W.; Lipton S.A.; Kelly J.W. Cerebral Organoids as an Alzheimer´s Disease Human Model. Presented at the *Proteostasis Consortium Retreat,* San Francisco, CA; May 22-23. 2022.

Prokop, S.; Miller, K.R.; **Labra, S.R**.; Pitkin, R.M.; Hoxha, K.; Rosenbloom, A.; Lee, V.M.Y.; Trojanowsk, J.Q. Impact of TREM2 Risk Variants on Brain Region-specific Immune Activation and Plaque Microenvironment in Alzheimer's Disease Patient Brain Samples. *Acta Neuropathologica.* 2019, 138(4), 613-630

Oner, B.S.; **Labra, S.R.**; Fehr, S. FDA Drug Regulation: Investigational New Drug Applications. In *Academic Entrepreneurship for Medical and Health Scientists.* 2019, 1(3), Article 7. DOI: 10.21428/b2e239dc.784553dd.

Current Research (expanded description): I am using a set of isogenic induced pluripotent stem cell lines with different familial Alzheimer's disease (AD) mutations and the complexity afforded by their differentiation into cerebral organoids as a novel system to model and study the progression and potential treatment of AD. By coordinating the expertise of multiple collaborator labs within and outside Scripps Research, I am ascertaining the extent to which my system faithfully recapitulates known functional and biochemical disease signatures while thoroughly characterizing the proteomic and lipidomic changes stemming from AD-associated mechanisms. In parallel to dissecting uncovered disease mechanisms, I am also interrogating the prevention and reversibility of the characterized pathology in the cerebral organoids by functionally and multi-omically testing promising pharmacologic agents for therapeutic and prophylactic effects and determining the feasibility of the model strategy as a higher throughput human drug development platform.

Benefits to Science and Society: Alzheimer's disease (AD) currently affects around 47 million people worldwide and like most other neurodegenerative diseases, still lacks robust disease mechanism descriptions and treatments. My project aims to be one of the most thorough in vitro AD model characterizations, leading not only to the discovery of novel mechanisms underlying the disease, but also enabling the testing of potential new drugs for therapeutic and prophylactic effects; the latter usually obscured in most traditional models, but with incalculable potential benefit in the clinic.

Personal Interests: Volunteer with Cientifico Latino as co-director of a mentorship program for underrepresented minorities serving more than 100 STEM graduate students nationwide.

ARCS Award: The ARCS Foundation award means being welcomed to a community of passionate and unique individuals, ranging from young scientists to generous donors, united by the goal of making a positive impact in the world. I am humbled and immensely grateful for the continuous inspiration and financial support that ARCS provides me to focus my research efforts to contribute to my field and advance my career.

GARRETT LEE LINDSEY

Scripps Research

Skaggs Graduate School of Chemical and Biological Sciences

Concentration: Chemical Biology

Specialization: Chemical Proteomics

Donor: The Reuben H. Fleet Foundation

In the Cravatt lab, Garrett uses the application of Activity-based Protein Profiling (ABPP) to discover and functionally annotate proteins that contribute to human diseases, such as cancer. His research focuses on developing small molecules that target novel proteins to suppress pro-tumorigenic transcriptional networks. Currently, he is studying the mechanism of small molecules that modulate the RNA-binding protein, NONO. Studying these small molecules could provide a way forward for drugging the NONO protein for cancer therapy and more specifically treatment resistant forms of prostate cancer.

Degree: B.S. in Pharmacology, University of California, Santa Barbara

Awards and Honors: Gordon Research Conference, CSURM Fellowship, 2022; Baylor College of Medicine, NIGMS Fellowship for Post-baccalaureate Research Education Program, 2019; National Institute of Health Fellowship for Summer Undergraduate Research, University of Oregon, 2017.

Publications, Papers, and Posters:

Lindsey, G.L.; Kathman, S.; Koo, J.; Her, S.; Blue, S.; Li H.; Jaensch, S.; Remsberg, J.; Ahn. K.; Yeo, G.; Cravatt B.F. Remodeling of Oncogenic Transcriptomes by Small Molecules Targeting the RNA-binding Protein NONO. Poster. *Gordon Research Conference 2022*. Andover, NH.

Lindsey, G.L.; Kandel, P.; Lyra, C.; Chamakuri, S.; Young, D.W. Targeted TLX Protein Degradation as Novel Therapy for Castration- Resistant Prostate Cancer. Poster. *The Annual Meeting ABRCMS 2019*. Anaheim, CA.

Andresen, R.; Degen, G.; Valois, E.; **Lindsey, G.L.**; Kristiansen, K. Siderophore Inspired Molecules to Mediate Collagen Thin Film Adhesion. *APS March Meeting Abstracts*. 2019.

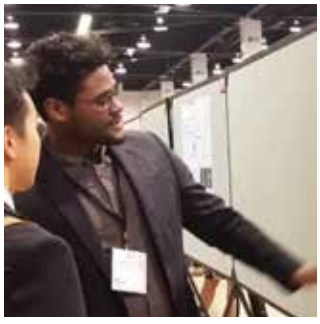
Lindsey, G.L.; Yasen, A.; Christie, A.D. The Impact of Physical Activity and Sleep on Physiology Following a mTBI. *International Journal of Exercise Science.* 2019, Vol. 12: Iss. 3, Pages 919 – 931.

Current Research (expanded description): A large amount of the human proteome is dedicated to mRNA homeostasis, but most RNA-binding proteins lack chemical probes. Therefore, my specific focus is on developing chemical probes capable of targeting previously reported "undruggable" RNA-binding proteins to suppress pro-tumorigenic transcriptional networks, which would provide great value to the study this class of proteins. Our lab has discovered an electrophilic small molecule that decreased transcripts encoding the androgen receptor and its V-7 splice variant. This phenotypic effect is due to the compound covalently engaging cysteine-145 on the RNA-binding protein NONO. Interestingly, we found that genetic disruption of NONO does not replicate the androgen receptor suppressing effects of the NONO ligands, but instead blocks the activity of these ligands. The effects we observe in targeting NONO with our unique chemical probes correlate with a blockade of cell growth and proliferation of cancer cells from a variety of lineages. I aim to leverage this effect to a more translational application to exploit this mechanism. Additionally, using covalent chemistry, this work can potentially provide a path of using chemical probes to target other RNA-binding proteins that were classified as undruggable and that play vital roles in the landscape of cancer cell biology.

Benefits to Science and Society: RNA binding proteins are implicated in many human diseases and oversee the maturation and quality control of mRNAs that encode key oncogenic proteins. Despite their fundamental roles in human physiology and disease, these proteins remain largely underexplored in terms of chemical probe and drug discovery. The research I am focusing on aims to further contribute this knowledge of this class of proteins for potential therapy of numerous diseases.

Personal Interests: I stay active through weightlifting, hot yoga, or practicing my golf swing at a driving range.

ARCS Award: I am grateful to be a part of the ARCS Foundation of Scholars. Receiving this award is incredibly motivating as it affirms that my efforts toward science are valued. In addition, this generous award allows me to focus on my research by relieving the financial stressors of graduate school. The ARCS Foundation award provides me with another medium in which I can share my research with the scientific community, and I am excited to do so!



COLLEEN ANN MAILLIE

Scripps Research

Skaggs Graduate School of Chemical and Biological Sciences

Concentration: Integrative Structural and Computational Biology

Specialization: Protein Engineering

Donor: Dorothy Georgens

Colleen combines protein engineering, computational design, and structural biology to understand how immune receptors transmit signals across cellular membranes. She is developing de novo transmembrane proteins to target Toll-like receptors. This class of immune receptors form a critical first line of defense against bacterial and viral infections and play a vital role in autoimmune diseases, cancers, and sepsis. Her research aims to provide a novel therapeutic targeting strategy and a way forward to better arm our immune systems against infections and disease.

Degree: B.S. in Computational Biology, University of Rochester

Awards and Honors: John and Susan Diekman Fellowship, The Skaggs Graduate School of Chemical and Biological 2020-2023; D.E. Shaw Graduate and Postdoc Women's Fellowship 2022; Sciences Dean's Research Fellowship 2020-2021

Publications, Papers, and Posters:

Maillie, C.A.; Golden, J.; Wilson, I.A.; Ward, A.B.; Mravic, M . Ab Initio Prediction of Specific Phospholipid Complexes and Membrane Association of HIV-1 MPER Antibodies by Multi-scale Simulations. *eLife.* 2023, 12:RP90139.

Maillie, C.A.; Ward, A.B.; Mravic, M. Computational Engineering of Toll-like Receptor 4 Signaling. Presentation. *Scripps and UCSF Conference* 2023. Cabo San Lucas, Mexico.

Maillie, C.A.; Golden, J.; Wilson, I.A.; Ward, A.B.; Mravic, M . Ab Initio Prediction and Characterization of Membrane Binding of HIV-1 Broadly Neutralizing Antibodies by Multiscale Simulations. Presentation. *Biophysical Society Annual Meeting* 2023. San Diego, CA.

Adams, Z.C.; Silvestri, A.P.; Chiorean, S.; Flood, D.T.; Balo, B.P.; Shi, Y.; Holcomb, M.; Walsh, S.I.; **Maillie, C.A.**; Pierens, G.K.; Forli, S.; Rosengren, K.J.; Dawson, P.E. *ACS Central Science.* 2023, 9 (4), 648-656.

Current Research (expanded version): Toll-like receptors are vital to the innate immune response, yet we lack a complete understanding of how these receptors couple structural dynamics with signaling outputs. This knowledge gap renders an underexploited class of immune receptors with limited therapeutic interventions. I am using a novel approach to target Toll-like receptor 4 (TLR4), a dimeric receptor on the surface of cells, by engineering interactions at the transmembrane domains. I employ molecular modeling to guide computational design of transmembrane peptides. These de novo amino acid sequences are customized to block the natural interactions of TLR4 transmembrane domains and inhibit downstream signaling. I currently am evaluating a suite of peptides for protein-protein interactions and functional inhibition of TLR4 in cell-based assays. I also am developing a high throughput screening pipeline to isolate TLR4 activating proteins. Using a combinatorial protein library based on a synthetic membrane protein scaffold, I am screening millions of distinct protein sequences for inflammatory pathway activation with a fluorescence activated cell sorting (FACS) assay. In this approach, I aim to engineer membrane proteins that activate TLR4 by binding and stabilizing an activated receptor complex.

Benefits to Science and Society: Our approach to targeting immune receptors at the transmembrane domain has potential to overcome challenges in specificity and tunability that other strategies face. If modified into peptide or mRNA delivered molecules, designed transmembrane proteins targeting TLR4 could have implications as vaccine adjuvants or components of cancer and autoimmune disease treatments. These proteins could also serve as adaptor molecules in cryoEM structural studies, where isolating relevant functional conformations and resolving structural details could improve rational drug design. Excitingly, successful engineering methods could be expanded to target other vital immune receptors at the membrane.

Personal Interests: I enjoy beach volleyball, surfing, good coffee, CrossFit, mornings at the dog beach, and coaching high school field hockey.

ARCS Award: To be recognized as an ARCS Scholar is validation that high risk and innovative research is valued by the community. The award motivates me to continue to push my research on technology for therapeutic targeting strategies to demonstrate how valuable these awards are for early career scientists. This generous award also relieves financial strain of graduate school in San Diego, and will allow me to refocus on scientific achievements in the coming year. I am excited to exchange ideas and motivation with others in the scientific community that ARCS hosts!

MICHAELA MEDINA

Scripps Research

Skaggs Graduate School of Chemical and Biological Sciences

Concentration: Cell Biology

Specialization: Quantitative Cellular Biology and Biophysics

Donor: ARCS Foundation – San Diego Chapter

Michaela uses light microscopy, electron microscopy, and biochemical techniques to investigate how mitochondria sense and adapt to cellular stress. Her work focuses on how mitochondrial membranes remodel in a variety of different cellular contexts to gain a greater understanding for how these processes are regulated. Her goal is to understand how dysregulation of mitochondrial dynamics results in unhealthy mitochondrial populations that are a hallmark of neurodegenerative diseases, metabolic diseases, and cancer.

Degree: B.S in Cell Biology and Biochemistry, University of California, San Diego

Awards and Honors: 2023 *NSPIRE Fellow; Biophysical Society Student Research Achievement Award, 2022; Scripps Research Graduate Symposium poster award, 2021; Southern California Cryo-EM Symposium poster award, 2021; Ford Foundation Predoctoral Fellowship Honorable Mention, 2021.

Publications, Papers, and Posters:

Mageswaran, S.K.; Grotjahn, D.A.; Zeng, X.; Barad, B.A.; **Medina, M.**; Hoang, M.H.; Dobro, M.J.; Chang, Y.W.; Xu, M.; Yang, W.Y.; Jensen, G.J. Nanoscale Details of Mitochondrial Constriction Revealed by Cryoelectron Tomography. *Biophysical Journal.* 2023, 122 (18), 3768-3782.

Barad, B.A.*; **Medina, M.***; Fuentes,D.; Wiseman, R.L.; Grotjahn, D.A., Quantifying Organellar Ultrastructure in Cryo-electron Tomography Using a Surface Morphometrics Pipeline. *Journal of Cell Biology.* 2023, 222 (4).

Newman, L.E.; Tadepalle, N.; Novak, S.W.; Schiavon, C.R.; Rojas, G.R.; Chevez, J.A.; Lemersal, I.; **Medina, M.**; Rocha, S.; Towers, C.G.; Grotjahn, D.A.; Manor, U.; Shadel, G.S., Endosomal Removal and Disposal of Dysfunctional, Immunostimulatory Mitochondrial DNA. *bioRxiv.* 2022, 2022.10.12.511955.

Gardner, A.; Autin, L.; Fuentes, D.; Maritan, M.; Barad, B.A.; **Medina, M**.; Olson, A.J.; Grotjahn, D.A.; Goodsell, D.S. CellPAINT: Turnkey Illustration of Molecular Cell Biology. *Frontiers in Bioinformatics.* 2021, 1 (7).

* These authors contributed to the work equally

Current Research (expanded description): The ability for mitochondria to sense and adapt to cellular stress is critical for cell survival. While there is a wealth of data characterizing the metabolic outputs of mitochondria in different physiological conditions, what remains unclear is how changes in protein complexes drive large-scale remodeling of important respiratory-machinery-containing membranes of the mitochondrion? To address this, I utilize cellular cryo-electron tomography (Cryo-ET) to collect high-resolution 3D-volumetric data of mitochondria in their surrounding environment. Recently, I developed new methodologies to quantitatively analyze mitochondrial membranes (ultrastructure) in different physiological contexts. I am applying these methods to understand the complex cellular machinery involved in the dynamic process of mitochondrial division (fission).

Benefits to Science and Society: Dysregulation of mitochondrial fission leads to highly fragmented mitochondrial populations which are hallmarks of neurodegenerative diseases, metabolic disorders, and cancer. By defining the organization of cellular machinery that aid in these large-scale ultrastructural changes, we gain a better understanding of the mechanistic underpinnings of mitochondrial dynamics and begin to explore new avenues for targeting and modulating mitochondrial function. Expanding beyond my biological focus, all ultrastructure analysis tooling will be open source and will aid in the quantitative analysis of organelle ultrastructure in cryo-ET.

Personal Interests: I am an avid music lover especially K-pop and the South Korean band BTS. I enjoy learning languages, reading, hiking, and traveling.

ARCS Award: I am grateful to have been selected as an ARCS scholar and am honored to be welcomed into such a wonderful group of innovative minds. This award will aid in my development as a scientific researcher and serves as an acknowledgment of my efforts thus far. I am enthused to continue my work with the generous support of the ARCS Foundation.

KAYLA ELAINE NUTSCH

Scripps Research

Skaggs Graduate School of Chemical and Biological Sciences

Concentration: Biomedical Sciences

Specialization: Chemical Biology

Donor: ARCS Foundation - San Diego Chapter

In her research, Kayla has performed a high-throughput drug screen to identify small molecules that inhibit the interaction between two proteins, YAP and TEAD, which regulate cell growth, organ size, and regeneration. This association of YAP and TEAD is often hyperactivated in human cancers driving cellular proliferation, metastasis, and chemotherapy resistance. Her work has uncovered small molecules that have been used to elucidate the unique regulation of TEAD and further developed them into pre-clinical candidates for novel cancer therapeutics.

Degrees: M.S. in Biochemistry, Kansas State University; B.S. in Biochemistry, Kansas State University

Awards and Honors: CIRM EDUC4 Training Program, 2022; Baxter Foundation Fellow, 2021-2022; Johnson Cancer Research Center Undergraduate Cancer Research Award, 2016; Candi Hironaka Outstanding Class Leader Award 2016

Publications, Papers, and Posters:

Nutsch, K.*; Song, L.*; Chen, E.; Hull, M.; Chatterjee, A.K.; Chen, J.J.; Bollong, M.J. A Covalent Inhibitor of the YAP-TEAD Transcriptional Complex Identified by High-throughput Screening. *RSC Chemical Biology*. 2023. doi: https://doi.org/10.1039/D3CB00044C.

Ibrahim, L.; Stanton, C.; **Nutsch, K**.; Nguyen, T.; Li-Ma, C.; Ko, Y.; Lander, G.C.; Wiseman, R.L.; Bollong, M.J. Succinylation of a KEAP1 Sensor Lysine Promotes NRF2 Activation. *Cell Chemical Biology*. 2023. doi: https://doi.org/10.1016/j.chembiol.2023.07.014.

Ko, Y.; Hong, M.; Lee, S.; Kumar, M.; Ibrahim, L.; **Nutsch, K**.; Stanton, C.; Sondermann, P.; Sandoval, B.; Bulos, M.L.; Iaconelli, J.; Chatterjee, A.K.; Wiseman, R.L.; Schultz, P.G.; Bollong, M.J. S-lactoyl Modification of KEAP1 by a Reactive Glycolytic Metabolite Activates NRF2 Signaling. *PNAS Cell Biology*. 2023, 120 (20), e2300763120. doi: https://doi.org/10.1073/pnas.2300763120.

Shalhout, S.Z.*; Yang, P.Y.*; Grzelak, E.M.*; **Nutsch, K.**; Shao, S.; Zambaldo, C.; Iaconelli, J.; Ibrahim, L.; Stanton, C.; Chadwick, S.R.; Chen, E.; DeRan, M.; Li, S.; Hull, M.; Wu, X.; Chatterjee, A.K.; Shen, W.; Camargo, F.D.; Schultz. P.G.; Bollong, M.J. YAP-dependent Proliferation by a Small Molecule Targeting Annexin A2. *Nature Chemical Biology.* 2021, 17 (7), 767-775. DOI: https://doi.org/10.1038/s41589-021-00755-0

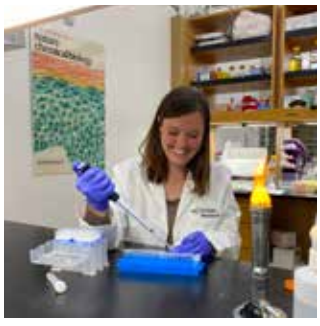
* These authors contributed to the work equally

Current Research (expanded description): Abnormal activation of YAP in cancers drives cellular proliferation, metastasis, chemoresistance, and immune suppression. As such, pharmacological inhibition of YAP by targeting its essential co-regulators, TEADs would likely promote tumor clearance in sensitive tumor types. To identify a novel inhibitor of the YAP-TEAD transcriptional complex I performed a fluorescence polarization-based high-throughput screen of over 800,000 diverse small molecules in collaboration with Calibr. From this screen we identified a novel scaffold that inhibits the association of YAP and TEADs, and further optimization uncovered a potent covalent inhibitor that occupies the conserved palmitoylation site on TEADs. We have extensively evaluated the ability of our preclinical lead candidate to suppress tumor progression in rodent xenograft models with promising results of stunted tumor growth and regression. While developing our therapeutic candidate we also discovered a set of compounds that can be utilized to further understand the physiological function of TEAD auto-palmitoylation. Among palmitoylated proteins, TEADs are unique; they are obligately auto-palmitoylated, with palmitate occupying an internal binding site. Molecular mechanisms have been proposed for TEAD palmitoylation, but the precise role and mechanism of action still needs in-depth investigation. These compounds will be used to elucidate the biophysical mechanisms and biological utility of auto-palmitoylation regulation.

Benefits to Science and Society: While mutations causing hyperactivated YAP are extensive in malignant mesotheliomas and a rare schwannoma, most YAP dependency in malignant tumors is induced following anti-cancer treatment, driving therapy resistance, and making it a key target for therapeutic intervention. The development of novel TEAD inhibitors have the potential to be developed into therapeutic agents for primary and combinatorial cancer treatment. In addition to therapeutic benefits, the discovered chemical tools can clarify the regulation of TEAD autopalmitoylation, a process that is not well understood.

Personal Interests: I enjoy painting, hiking with my dog, yoga, exploring local breweries with my husband, reading, cooking, traveling, and experimenting in mixology.

ARCS Award: I am honored to be chosen as an ARCS Scholar and be recognized for the research I have conducted. The generous support provided by the ARCS Foundation makes groundbreaking research at the forefront of translational medicine possible for graduate students like myself. As I begin to think about my future career path, I am often reminded that the people and communities surrounding us are who drive our research goals. I look forward to working with the strong community of ARCS Foundation Scholars.



CAROLINE ROSE STANTON

Scripps Research

Skaggs Graduate School of Chemical and Biological Sciences

Concentration: Biomedical Sciences

Specialization: Chemical Biology

Donor: Donald C. and Elizabeth M. Dickinson Foundation

Caroline's graduate research focuses on understanding the regulation of the NLRP3 inflammasome, a protein complex closely tied to sterile inflammation in numerous diseases including gout, rheumatoid arthritis, multiple sclerosis, and stroke. To accomplish this goal, she has performed a high-throughput screen to identify new compounds which inhibit NLRP3 and is determining the mechanism of action of these compounds to establish new ways by which NLRP3 is regulated. This allows her to identify potential new drug targets to reduce NLRP3 activity and inflammation.

Degree: B.S. in Chemistry, University of North Carolina at Chapel Hill

Awards and Honors: 2023 *NSPIRE Kellogg Fellow in the Skaggs Graduate School of Chemical and Biological Sciences 2019; Phi Beta Kappa 2017; James H. Maguire Memorial Award Recipient for Outstanding Academic Achievement in Chemistry 2017

Publications, Papers, and Posters:

Stanton, C.; Sun, J.; Nutsch, K.; Rosarda, J. D.; Nguyen, T.; Li-Ma, C.; Kutseikin, S.; Saez, E.; Teijaro, J. R.; Wiseman, R. L.; et al. Covalent Targeting as a Common Mechanism for Inhibiting NLRP3 Inflammasome Assembly. *bioRxiv.* 2023. DOI: 10.1101/2023.06.01.543248.

Ibrahim, L.; **Stanton, C.**; Nutsch, K.; Nguyen, T.; Li-Ma, C.; Ko, Y.; Lander, G. C.; Wiseman, R. L.; Bollong, M. J. Succinylation of a KEAP1 Sensor Lysine Promotes NRF2 Activation. *Cell Chemical Biology.* 2023. DOI: https://doi.org/10.1016/j.chembiol.2023.07.014.

Ko, Y.; Hong, M.; Lee, S.; Kumar, M.; Ibrahim, L.; Nutsch, K.; **Stanton, C.**; Sondermann, P.; Sandoval, B.; Bulos, M. L.; et al. S-lactoyl Modification of KEAP1 by a Reactive Glycolytic Metabolite Activates NRF2 Signaling. *Proceedings of the National Academy of Sciences.* 2023, 120 (20). DOI: 10.1073/pnas.2300763120 (accessed 2023-06-16T19:02:58).

Shalhout, S.Z.; Yang, P.-Y.; Grzelak, E.M.; Nutsch, K.; Shao, S.; Zambaldo, C.; Iaconelli, J.; Ibrahim, L.; **Stanton, C.**; Chadwick, S.R.; Chen, E.; Deran, M.; Li, S.; Hull, M.; Wu, X.; Chatterjee, A.K.; Shen, W.; Camargo, F.D.; Schultz, P.G.; Bollong, M.J. YAP-Dependent Proliferation by a Small Molecule Targeting Annexin A2. *Nature Chemical Biology.* 2021, 17 (7), 767-775

Current Research (expanded description): Despite the growing recognition of the contribution of NLRP3 in inflammatory disorders, there is still much not understood regarding the activation and regulation NLRP3 inflammasome signaling, limiting our ability to develop pharmacologic approaches to target this important inflammatory complex. Recent identification of covalent molecules which inhibit NLRP3 suggests that NLRP3 may serve as an electrophile sensor within the cells and may be a promising covalent drug target. I am employing a chemical genetic approach to elucidate the biologic and therapeutic potential of covalent cysteine modification of NLRP3 for regulating inflammasome activation and activity. To do this, I developed and implemented a high-throughput screen for inhibitors of NLRP3 inflammasome assembly to identify covalent compounds that inhibit inflammasome assembly and activity. Next, I will define the molecular basis for compound-dependent inhibition of inflammasome assembly with the explicit goal of characterizing a redox sensor mechanism of NLRP3 activation and activity. Further, I will identify compounds with therapeutic potential for protecting against inflammatory disorders through inflammasome inhibition for further translational development.

Benefits to Science and Society: Overactivity of the NLRP3 inflammasome is implicated in numerous inflammatory diseases, yet there are no clinically approved NLRP3 inhibitors. Most of the current clinical candidates work through inhibition of the ATPase activity of NLRP3. However, this research demonstrates an intrinsic electrophile sensing mechanism of regulation of NLRP3 which makes it an ideal covalent drug target. By characterizing this activity, we demonstrate the therapeutic potential of a highly-specific covalent NLRP3 inhibitor for treatment of inflammatory diseases.

Personal Interests: Classical singing including art songs and opera, walking on the beach, reading, and baking.

ARCS Award: I am extremely grateful to be selected as an ARCS Scholar and appreciative of your support of my career as a scientist. It is very gratifying to receive recognition of my efforts and to know that there are people who recognize the importance of training a new generation of scientists.

This scholarship will be pivotal in helping me develop my potential and advance my training. I've always believed that research science is the way I can most impact the world and make a difference in the lives of many. I hope that both during graduate school and afterwards, I can refine my scientific knowledge and apply my talents to the treatment and curing of devastating diseases. When I graduate from this program, I will be ready to contribute my full effort to the development of new therapies and treatments and make a lasting impact on society. Your support will help contribute to my success and I cannot thank you enough for your generosity.

UC San Diego

ANELA KANANI AKIONA

University of California San Diego

Scripps Institution of Oceanography

Concentration: Marine Biology

Specialization: Coral Reef Ecology

Donor: Kenneth and Marjorie Blanchard/ARCS Foundation - San Diego Chapter

Anela studies what determines species distribution on coral reefs, which are under threat from climate change. She uses data from scuba surveys to model how emerging interventions might make reef ecosystems in the Maldives, an island nation which relies heavily on coral-related tourism, more resilient as global temperatures rise. Her research seeks to bridge the gap between conservationists, managers, and scientists as the Maldivian government works to build their national coral conservation strategy.

Degrees: M.S. in Marine Biology, University of Hawaii at Mānoa; B.A. in Marine Science, University of San Diego

Awards and Honors: Tribal Membership Initiative Fellowship 2021-2023; National Science Foundation Graduate Research Fellowship 2018-2021; Hauoli Mau Loa Graduate Fellowship, University of Hawaii 2016-2018; Kamehameha Schools Imi Naauao Scholarship 2016-2018

Publications, Papers, and Posters:

Akiona, A.K.; B.J.; Popp, B.N.; Toonen, R.J.; Siple, M.C.; Kotubetey, K.; Kawelo, H.; Franklin, E.C. Predatory Fish Diets Shift Towards an Invasive Mullet in a Traditional Hawaiian Aquaculture System. *Aquaculture Fish and Fisheries.* 2022, 1-14.

Akiona, A.K.; Zgliczynski, B.J.; Sandin, S.A. Length-weight Relationships for 18 Coral Reef Fish Species from the Central Pacific. *Journal of Applied Ichthyology.* 2021, 00, 1-5.

Peyton, K.A.; Sakihara, T.S.; Nishiura, L.K.; Shindo, T.T.; Shimoda, T.E.; Hau, S.; **Akiona, A. K.;** Lorance, K. Length-weight Relationships for Common Juvenile Fishes and Prey Species in Hawaiian Estuaries. J*ournal of Applied Ichthyology.* 2015, 32, 499-502.

Current Research (expanded description): Coral interventions are being developed as tools for scientists and reef managers to mitigate the effects of climate change on coral reefs. Understanding how corals and benthic functional groups may respond to potential interventions should help managers protect and restore coral reefs as the climate effects (particularly bleaching) become more frequent and more severe. I use an empirically grounded, spatially explicit model to assess potential interventions for the Republic of the Maldives, an island nation which depends heavily on coral reef related tourism and which has recently embraced reef restoration. My research draws on extensive Maldives survey data from the 100 Island Challenge, a large-scale effort to describe variation in coral reefs from across the globe, to model different intervention scenarios, including business as usual and larval outplanting. This project is part of a larger effort that is one of the first to create decision-making tools for and in collaboration with coral reef managers and stakeholders.

Benefits to Science and Society: Many of the available coral interventions are quite new and have not been implemented widely yet, which makes it difficult for conservation practitioners and managers to know which will be most effective or to switch from what they already have in practice. My research seeks to make the decision-making process more straightforward by simulating interventions in the Maldives, with potential application to other locations.

Personal Interests: I enjoy scuba diving, hiking, going to the beach, reading, cooking, and fostering dogs.

ARCS Award: I am very grateful and honored for the opportunity to be an ARCS scholar, which will greatly alleviate financial stress while completing my PhD, and allow me to continue my work in outreach and mentorship.

KRISTA PATRICE BALTO

University of California San Diego

Department of Chemistry and Biochemistry

Concentration: Chemistry

Specialization: Inorganic Synthesis and Materials Chemistry

Donor: Wally Schirra Memorial Endowment Fund

Krista's research focuses on the creation of unique, highly reactive metal-based materials. Once created, Krista determines what these materials are capable of; some aid in the creation of organic molecules or polymers, like plastics, while others are capable of gas and liquid separations for industrial purposes.

Degrees: M.S. in Chemistry, University of California, San Diego; B.S. in Chemistry, University of Delaware

Awards and Honors: Distinguished Graduate Student Fellowship, December 2022; ARCS Scholar 2022-2024; Teddy Traylor Award, June 2022; MRSEC Director's Publication Award, October 2022.

Publications, Papers, and Posters:

Balto, K.P.; Sikma, R.E.; Figueroa, J.S.; Cohen, S. Metal Organic Frameworks with Low Valent Metal Nodes Angew. *Chem. Int*. *Ed.* 2022, 61 (33), e202206353.

Balto, K.P.; Wang, Y.; Chen, A.; Figueroa, J. S.; Pascal, T.; Tao, A. R. Curvature-Selective Nanocrystal Surface Ligation Using Sterically-Encumbered Metal-Coordinating Ligands. *ACS Nano*. 2022, 16.

Balto, K.P.; Gembicky, M.; Rheingold, A. L.; Figueroa, J. S. Crystalline Hydrogen-Bonding Networks and Mixed-Metal Framework Materials Enabled by an Electronically Differentiated Heteroditopic Isocyanide/Carboxylate Linker Group. *Inorganic Chemistry*. 2021, 60 (16), 12545-12554.

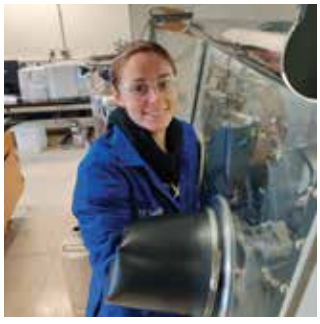
Lorzing, G. R.; **Balto, K.P.**; Antonio, A. M.; Trump, B. A.; Brown, C. M.; Bloch, E. D. Elucidating the Structure of the Metal–Organic Framework Ru-HKUST-1. *Chem. Mater.* 2020, 32, 18, 7710–7715. DOI: 10.1021/acs.chemmater.0c01944.

Current Research (expanded description): Krista's research focuses on the synthesis and characterization of m-terphenyl isocyanide based materials. She has synthesized a variety of novel low valent metal-organic framework materials to study their applications in catalysis and small molecule activation. In addition, she collaborates with the Department of Nanoengineering at UCSD on gold and silver nano-particle separations using designer isocyanide ligands.

Benefits to Science and Society: Due to the isolobal nature of isocyanides to carbon monoxide (CO), sterically bulky m-terphenyl isocyanide ligands have allowed for the stabilization and isolation of low-valent transition metal complexes involved in a variety of catalytic cycles. Without the use of such isocyanide ligands, understanding of the electronic structure and reactivity of intermediate metal-carbonyl complexes involved in catalysis would not be possible. Expanding this chemistry to materials has many potential applications in heterogeneous catalysis and reactivity.

Personal Interests: I enjoy weightlifting, surfing, running, trying new restaurants, and traveling.

ARCS Award: The ARCS Foundation award will allow me to continue my studies without worrying about inflation and rent prices in San Diego County. Receiving this award validates my research abilities and increases my confidence as a woman in STEM.



DANIEL MILGRAM BEAGLEHOLE

University of California San Diego

Jacobs School of Engineering

Concentration: Computer Science and Engineering

Specialization: Machine Learning

Donor: Beyster Family Foundation

One of the biggest mysteries in the study of deep learning is why neural networks are able to perform well at test time (i.e., on data that was not used for learning). Daniel's work demonstrates that neural networks achieve this remarkable test performance by learning a particular statistic that is specific to the given dataset (a phenomenon known as feature learning). Daniel has shown how this mechanism can explain a variety of "intelligent" behaviors in deep learning, including the emergence of edge detectors in networks used for vision tasks. Further, Daniel demonstrated that the mechanism of feature learning identified in his work can be implemented in a simple, fast, and interpretable method that gives state-of-the-art performance on tabular data.

Degrees: M.S. Computer Science, Columbia University; B.S. Mathematics, University of Chicago

Publications, Papers, and Posters:

Beaglehole, D.; Radhakrishnan A.; Pandit, P.; Belkin, M. Mechanism of Feature Learning in Convolutional Neural Networks. 2023. *arXiv* preprint. arXiv:2309.00570

Radhakrishnan A.; **Beaglehole, D**.; Pandit, P.; Belkin, M. Mechanism of Feature Learning in Deep Neural Networks and Kernel Machines that Recursively Learn Features. *arXiv* preprint. 2022, arXiv:2212.13881

Beaglehole, D.; Belkin, M; Pandit, P. On the Inconsistency of Kernel Ridgeless Regression in Fixed Dimensions. *SIAM Journal on the Mathematics of Data Science.* 2023

Beaglehole, D.; Hopkins, M.; Kane, D.; Liu, S.; Lovett, S. Sampling Equilibria: Fast No-Regret Learning in Structured Games. In *Proceedings of the 2023 Annual ACM-SIAM Symposium on Discrete Algorithms (SODA)* pp. 3817-3855. Society for Industrial and Applied Mathematics.

Current Research (expanded description): In our research, we have identified that neural networks recover a specific statistic of the input data distribution, known as the average gradient outer product (AGOP), in the uncentered covariance of their weight matrices (at every layer of the network). In fully-connected networks, the AGOP effectively re-weights input dimensions so as to emphasize coordinates that are relevant for the prediction task and de-emphasize less useful coordinates. This improves performance by reducing the dimensionality of the input without removing relevant information. We show that the AGOP explains a number of phenomena in deep learning including learning multi-index models, spurious correlations, and the simplicity bias. We also demonstrate that this method can be implemented outside of a neural network in a kernel method we call RFM, which achieves state-of-the-art performance on tabular data.

In convolutional neural networks (CNNs), we demonstrate that a similar mechanism holds - the covariances of the filters in CNNs learn the AGOP additionally averaged over patches in input images. We demonstrate that the AGOP on patches recovers edge detectors in state-of-the-art vision models such as AlexNet, VGG, and ResNets. Further, the eigenvectors of the AGOP of a kernel machine resemble Gabor filters of different orientations, a connection previously made for AlexNet.

We also verified the same mechanism holds for large language models and recurrent neural networks, though these results are unpublished. In these networks, we observe that the AGOP captures grouping of words of the same theme.

Benefits to Science and Society: Deep neural networks are the backbone of the most prominent and, perhaps, the most consequential AI applications in society. In particular, all large language models (e.g. ChatGPT) and most, if not all, vision models (e.g. as used in self-driving cars) are neural networks of some type. Despite their ubiquity in practice, and the implications of their usage, we lack a precise explanation for their performance, even in the simplest cases. It is very likely that if we can derive such an explanation that we can simplify these models significantly, improve their robustness and safety, and improve their performance.

Personal Interests: Research is my passion, but I am also an avid Brazilian Jiu Jitsu practitioner. I also enjoy playing guitar, learning to surf, and reading philosophy.

ARCS Award: I am extremely honored and grateful to have received the ARCS Foundation award. This award will support my goal to clarify the most important and puzzling questions surrounding the performance of vision models and large language models.

LAURA LYNN BECERRA

University of California San Diego

Jacob School of Engineering

Concentration: Electrical and Computer Engineering

Specialization: Medical Devices and Systems

Donor: ARCS Foundation - San Diego Chapter

Laura's research focuses on flexible sensor systems and haptic materials (which convey information via sense of touch) for physiological measurements. Her sensors are used to measure breathing activity in humans, as well as to prevent scar tissue from radiation treatments in the throats of cancer patients. She also investigates materials and their properties to create a desired touch sensation in humans, such as moisture or temperature. This is used for developing realistic technology to be used in surgical training simulations, virtual doctor visits, and virtual reality platforms, among other applications.

Degrees: M.S. in Electrical Engineering, University of California, San Diego; B.S./B.A. in Electrical Engineering, University of San Diego

Awards and Honors: UC President's Dissertation Year Fellowship, 2023; National Science Foundation Graduate Research Fellowship, 2019; Electrical and Computer Engineering Department Fellowship, 2019.

Publications, Papers, and Posters:

Becerra, L.L.; Rafeedi, T.; Ramanarayanan, S.; Frankel, I.; Yalcin, C.; Garudadri, H.; Ng, TN. Bi-directional Venturi Flowmeter with Capacitive Foam Sensing for Spirometry Measurements. *Advanced Materials Technologies.* 2023. DOI:10.1002/admt.202300627

Polat, B.; Rafeedi, T.; **Becerra, L.L.**; Chen, A.X.; Chiang, K.; Kaipu, V.; Blau, R.; Mercier, P.P.; Cheng, C.; Lipomi, D.J. External Measurement of Swallowed Volume During Exercise Enabled by Stretchable Derivatives of PEDOT:PSS, Graphene, Metallic Nanoparticles, and Machine Learning. *Advanced Sensor Research.* 2023 2(4). DOI: 10.1002/adsr.202200060

Blau, R.; Chen, A.X.; Polat, B.; **Becerra, L.L.**; Runser, R.; Zamanimeymian, B.; Choudhary, K.; Lipomi, D.J. Intrinsically Stretchable Block Copolymer Based on PEDOT:PSS for Improved Performance in Bioelectronic

Applications. *ACS Applied Materials & Interfaces*. 2022 14(4), 4823-4835 DOI: https://doi.org/10.1021/acsami.1c18495

Polat, B.; **Becerra, L.L.**; Hsu, P.; Kaipu, V.; Mercier, P.P.; Cheng, C.; Lipomi, D.J. Epidermal Graphene Sensors and Machine Learning for Estimating Swallowed Volume. ACS Applied Nano Materials. 2021 4(8), 8126-8134 DOI: https://doi.org/10.1021/acsanm.1c01378

Current Research (expanded description): The broad objective of my research is to improve medical device technology. I have worked towards this goal in two research areas: flexible sensors and haptic materials. I have fabricated flexible capacitive foam sensors to develop a spirometer device capable of measuring bi-directional airflow from human breath. I have also contributed to a project using graphene strain sensors with metallic nanoislands and electromyography electrodes made of conductive polymer as a wearable device. This wearable sensor device is placed on the throats of human subjects to predict swallowed liquid volumes by the subjects with the use of machine learning. We also used these sensors on the throats of cancer patients at the MD Anderson Cancer Center to prevent dysphagia development from radiation treatments.

Haptic materials are used in technologies that transmit information through the sense of touch. I have conducted human subject experiments to psychophysically test user tactile perception of certain sensations, such as moisture and temperature. This has been tested with polyacrylamide hydrogels of different stiffnesses soaked in liquids of different thermal conductivities. I am also investigating the use of magnetically actuated ferrofluid for different perceived thermal sensations. Improved haptic materials will contribute to more realistic sensations in haptic technology.

Benefits to Science and Society: Flexible sensors are extremely beneficial for medical technology. In my applications, they can play a key role in preventing and diagnosing respiratory illnesses and in detecting dysphagia development in the throats of cancer patients. Haptic materials (which convey sense of touch) contribute to realistic human-machine interfaces in devices such as surgical training simulations, tele-operations, and remote doctor visits. Both avenues show promise in improving physiological measurements and human-machine interfaces.

Personal Interests: I enjoy salsa and bachata dancing, baking, and spending time with friends and family.

ARCS Award: I am extremely grateful to be selected as an ARCS Scholar. I am eager to have the opportunity to share my research with the ARCS community and network with other enthusiastic Scholars. This award has also relieved a tremendous amount of financial stress and will allow me to focus more of my attention on research. As a woman in a male-dominated field, it is also very inspiring to be a part of a national organization started entirely by women. I hope to create new knowledge in my field with the use of the amazing benefits and tools of this fellowship.

ALEC JOSEPH CALAC

University of California San Diego

Herbert Wertheim School of Public Health and Human Longevity Science

Concentration: Global Health

Specialization: Medicine and Public Health

Donor: Lambert Foundation for Education

Alec is an MD/PhD Candidate at UC San Diego School of Medicine and Herbert Wertheim School of Public Health and Human Longevity Science. He works collaboratively with the Global Health Policy and Data Institute on research projects integrating social media, health technology, health policy, and Tribal public health. He currently serves as the National President of the Association of Native American Medical Students. In 2022, he was named a 40 Under 40 Leader in Minority Health by the National Minority Quality Forum and was also chosen to participate in the White House Leaders in Health Equity Roundtable Series.

Degree: B.S. in Neuroscience and Cognitive Science and Molecular and Cellular Biology, University of Arizona

Awards and Honors: California Area Local Impact Award, National Indian Health Board 2021; Clinton Global Initiative University, Clinton Foundation 2021; Trainee Leadership Award, Building the Next Generation of Academic Physicians 2020; Outstanding Community Leader Award, University of California San Diego Graduate Division 2020

Publications, Papers, and Posters:

Mackey, T.K.; **Calac, A.J.;** Keshava B.S.; Yracheta, J; Tsosie, K.S.; Fox, K. Establishing a Blockchain-enabled Indigenous Data Sovereignty Framework for Genomic Data. *Cell*. 2022;185(15):2626-2631. DOI:10.1016/j.cell.2022.06.030.

Calac, A.J.; Hoss, A. Vaccine Passports and Indian Country: Nothing Fast About It [published online ahead of print, 2022 Jun 1]. *Public Health Rep*. 2022;333549221094557. DOI:10.1177/00333549221094557.

Calac, A.J.; Haupt, M.R.; Li, Z.; Mackey, T. Spread of COVID-19 Vaccine Misinformation in the Ninth Inning: Retrospective Observational Infodemic Study. *JMIR Infodemiology.* 2022;2(1):e33587. Published 2022 Mar 16. DOI:10.2196/33587.

Calac, A.J.; Southwell, BG. How Misinformation Research Can Mask Relationship Gaps that Undermine Public Health Response. *Am J Health Promot*. 2022;36(3):561-563. DOI:10.1177/08901171211070951.

Current Research (expanded description): There is growing interest in using big data and machine learning approaches to capture and analyze user behaviors in the emerging interdisciplinary field of infoveillance, defined as using sources of Internet data, including via social media platforms, to identify and characterize information about human behavior, particularly in the context of public health. I am particularly interested in the ethical issues that arise when researchers wish to conduct social media research involving Native Americans. I have previously conducted research on how social media users respond to COVID-19 vaccine-related outreach events using vaccine hesitancy frameworks developed by the World Health Organization. I hope to develop and expand on existing frameworks for responsible conduct of research that respects all ethical, legal, and social considerations.

Benefits to Science and Society: Research involving Native American Tribes has long been extractive, with little to no benefit for the communities involved. I am the first from my Tribe to pursue an MD/PhD, hoping to challenge the status quo and ensure that health research involving Native American Tribes is linked to the priorities of their communities. I hope this will minimize potential harm and maximize the potential benefit that such research may yield.

Personal Interests: Homemade ice cream, indoor rock climbing, mentoring youth, exploring craft breweries, and checking out new coffee shops.

ARCS Award: The ARCS Foundation award means everything to me as a Native American scholar. An investment in me is an investment in my community.

AUSTIN JOSEPH CARTER

University of California San Diego

Scripps Institution of Oceanography

Concentration: Geosciences

Specialization: Geochemistry

Donor: The Reuben H. Fleet Foundation

Austin studies the chemistry, shape, and concentration of mineral dust (fine-grained particles of rock) trapped in polar ice. He drills cores of ice on the East Antarctic Ice Sheet, carefully separates the dust, and measures its properties. These small, solid impurities can provide insight into how the conditions on the Earth's surface and the flow of air may have changed through time. By understanding how the environment has changed in the past, his research aims to better project how the environment will change in the future.

Degrees: M.S. in Earth Sciences, University of California, San Diego; B.S. in Earth and Environmental Sciences, University of Michigan

Awards and Honors: Geological Society of America Graduate Student Geoscience Grant, 2022; Awards for Geochronology Student Research 2, 2021; U.S. Department of Defense: Antarctic Service Medal, 2021; AGU Cryosphere Innovation Award, 2020

Publications, Papers, and Posters:

Carter, A.J.; Aarons, S.M.; Schnaubelt, J.C.; Tabor, C.R.; Higgins, J.A.; Shackleton, S.A.; Epifanio, J.A.; Morgan, J.D.; Koornneef, J.M.; Gabrielli, P.; Choi, A.; Severinghaus, J.P.; Brook, E.J.; Kurbatov, A.V.; Marks Peterson, J.C.; Ice Core Record of Mineral Dust Variability Across the MIS 6 to 5e Transition at the Allan Hills, East Antarctica, in prep.

Wendt, K.A.; Bennett, H.I.; **Carter, A.J**.; Marks-Peterson, J.C. Our Frozen past: Ice Core Insights into Earth's Climate History. *Past Global Changes Magazine*. 2022. DOI:10.22498/pages.30.2.102, 2022.

Carter, A.; Aarons, S.M.; Higgins, J.A.; Shackleton, S.; Epifanio, J.; Morgan, J.D.; Severinghaus, J.P.; Brook, E.J.; Kurbatov, A.; Gabrielli, P. Characterizing the Source of Mineral Dust in Ice from the Allan Hills, East Antarctica during the Last Interglacial Period. *American Geophysical Union Fall Meeting 2021*.

Current Research (expanded description): During an ice age, Earth's climate is punctuated by periods of cold temperature marked by rapid glacial growth (glacial periods) alternating with periods of warmer climate marked by glacial retreat and/or stagnation (interglacial periods). The concentration, composition, and transport of mineral dust is dependent on the climate-regime, with markedly higher dust fluxes during glacial periods compared to interglacial periods. My research studies the transition from a glacial period into the last interglacial period (145,000-120,000 years ago). Characterizing dust source during the last interglacial period is analytically challenging due to the low quantities of material in the ice. Previous work has indicated that dust deposition during the last interglacial period was distinct with a young volcanic composition characteristic of the West Antarctic Rift System. This distinct dust composition implies a major change in atmospheric dynamics and/or exposure of material. To further constrain the source region, my research probes the mineral dust record contained within high-volume and high-resolution ice from the Allan Hills Blue Ice Area.

Benefits to Science and Society: During the last interglacial period, the climate was 3 degrees Celsius warmer than the pre-industrial era and the sea level was about 5.5-9 meters higher than today. Moreover, it is speculated that the West Antarctic Ice Sheet was severely diminished in size during the last interglacial period. By understanding what happened during the last interglacial period, my goal is to provide information on future possible major changes in the extent of the Antarctic ice sheet.

Personal Interests: I enjoy listening to music, exploring the beach, and making paper crafts.

ARCS Award: One day, I hope to become an influential leader in an increasingly vital field of study—the frozen part of our planet. The generous support of the ARCS Foundation provides added motivation and momentum needed toward this career aspiration. Thank you sincerely for supporting my educational pursuits and my path towards a career in science.

KELLEN JAMES CAVAGNERO

University of California San Diego

Department of Dermatology

Concentration: Immunology and Microbiology

Specialization: Inflammation and Infectious Disease

Donor: Dr. Patricia Judd

Kellen's mission is to better understand the immune system in order to more effectively prevent and treat infectious disease, autoimmunity, allergy, and cancer. Specifically, his research focuses on defining what happens after initial exposure to an inflammatory stimulus. Prior to starting his PhD, Kellen made significant contributions to the field of allergic airway disease under the mentorship of Dr. Taylor Doherty. Now, as a PhD student under the mentorship of Dr. Richard Gallo, his work is changing how we think about skin and gut infectious and inflammatory diseases.

Degree: B.S. in Pharmacology, University of California, Santa Barbara

Awards and Honors: National Cancer Institute Outreach Award, 2022; Society for Investigative Dermatology, Future Leaders Retreat Invitation, 2022; National Science Foundation Graduate Research Fellowship, 2021; UCSD Gastroenterology T32 Predoctoral Fellowship, 2020.

Publications, Papers, and Posters:

Marotz, C.; **Cavagnero, K.J.**; Song, S.J.; McDonald, D.; Wandro, S.; Humphrey, G.; Bryant, M.; Ackermann, G.; Diaz, E.; Knight, R. Evaluation of the Effect of Storage Methods on Fecal, Saliva, and Skin Microbiome Composition. *mSystems*. 2021, 6 (2). DOI: 10.1128/mSystems.01329-20 (co-first authors).

Cavagnero, K.J.; Badrani, J.H.; Naji, L.H.; Amadeo, M.B.; Leng, A.S.; Lacasa, L.D.; Strohm, A.N.; Renusch, S.R.; Gasparian, S.S.; Doherty, T.A. Cyclic-di-GMP Induces STING-Dependent ILC2 to ILC1 Shift During Innate Type 2 Lung Inflammation. *Front Immunol*. 2021, 12, 618807. DOI: 10.3389/fimmu.2021.618807.

Cavagnero, K.J.; Badrani, J.H.; Naji, L.H.; Amadeo, M.B.; Shah, V.S.; Gasparian, S.; Pham, A.; Wang, A.W.; Seumois, G.; Croft, M.; et al. Unconventional ST2- and CD127-negative Lung ILC2 Populations are Induced by the Fungal Allergen Alternaria alternata. *J Allergy Clin Immunol*. 2019, 144 (5), 1432-1435.e1439. DOI: 10.1016/j.jaci.2019.07.018.

Karta, M. R.; **Cavagnero, K.**; Miller, M.; Badrani, J.; Naji, L.; Doherty, T. A.; Broide, D. H. Platelets Attach to Lung Type 2 Innate Lymphoid Cells (ILC2s) Expressing P-selectin Glycoprotein Ligand 1 and Influence ILC2 Function. *J Allergy Clin Immunol.* 2019, 144 (4), 1112-1115.e1118. DOI: 10.1016/j.jaci.2019.06.001 (co-first authors).

Current Research (expanded description): The goal of my current research is to uncover novel and critical functions of dermal fibroblasts in skin immune defense. It is now recognized that fibroblasts are a heterogeneous population, not a single cell type only responsible for production of matrix and scar. These spindle-shaped cells take on a variety of distinct functional states that are specific to tissue location and environment. In addition to the classical activity of fibroblasts to produce extracellular matrix, fibroblasts have also been shown to exhibit immune activity. My work suggests that fibroblasts in the skin act directly in innate immune defense by producing antimicrobial peptides and driving neutrophil recruitment, leading me to the hypothesis that fibroblasts serve a previously unappreciated role as central coordinators of cutaneous inflammation and host defense. My thesis work in the Gallo lab focuses on understanding the mechanisms used by fibroblasts to promote neutrophil chemotaxis and antimicrobial activity, uncovering how fibroblasts are activated to initiate host defense functions, and determining the significance of fibroblast activity in vivo.

Benefits to Science and Society: Current improvements in the treatment of skin diseases have come from an increased understanding of how keratinocytes and classical, bone marrow-derived immunocytes participate in the skin immune system. However, many inflammatory and infectious skin diseases with serious impact on human health remain inadequately treated and without cures. An opportunity to advance treatment may come from more research on other cell types in the skin that appear to play important immunological functions.

Personal Interests: I enjoy spending time with friends and family and outdoor activities like surfing, hiking, and scuba diving.

ARCS Award: The cost of living near my university has skyrocketed in recent years, while my stipend has remained the same. The extra financial support provided by the ARCS Foundation will give me the freedom to spend more time thinking about my research rather than my finances. I am grateful and honored to have received the award.

MINERVA CONTRERAS

University of California San Diego

School of Medicine

Concentration: Neurosciences

Specialization: Molecular Neurobiology

Donor: ARCS Foundation – San Diego Chapter

The brain can modify its connections in response to experience, this is known as plasticity. During development, the brain's ability to respond to experience by making new connections, strengthening, or eliminating old ones, is high. As one gets older, this ability decreases. This explains why learning a new language is easier when one is young, for example. Minerva studies the mechanisms by which astrocytes, a type of non-neuronal cell, regulate plasticity in response to experience. She also hopes to elucidate therapeutic targets for neurodevelopmental diseases where plasticity alterations are hallmarks.

Degree: M.S. in Neuroscience, University of California, San Diego; B.S. in Biotechnology, Universidad Autonoma de Queretaro, Mexico

Awards and Honors: 2022-2025 Predoctoral Fellowship, NASEM, Ford Foundation Fellowship; 2021-2022 Honorable Mention, NSF Graduate Research Fellowship; 2020-2021 Neurosciences Graduate Program T32 Trainee, UC San Diego; 2019-2020 Summer Training Academy for Research Success Graduate Fellowship, UC San Diego

Publications, Papers, and Posters:

Labarta-Bajo, L.; Deng, J.; **Contreras, M.**; Allen, N.J. Protocol for the Purification and Transcriptomic Analysis of Mouse Astrocytes using GFAT. *STAR Protocols*. 2023, Sept, 102599, ISSN 2666-1667, https://doi.org/10.1016/j.xpro.2023.102599.

Bosworth, A.P.; **Contreras, M.**; Weiser Novak, S.; Sancho, L.; Salas, I.H.; Manor, U.; Allen, N.J. Astrocyte Glypican 5 Regulates Synapse Maturation and Stabilization. *bioRxiv*. 2023.03.02.529949; DOI: https://doi.org/10.1101/2023.03.02.529949.

Sancho, L.; **Contreras, M.**; Allen, N.J. Glia as Sculptors of Synapti Plasticity. *Neuroscience Research.* 2020 Dec 11:S0168- 0102(20)30488-0. DOI: 10.1016/j.neures.2020.11.005. PMID: 33316304. https://doi.org/10.1016/j.neures.2020.11.005.

Minata, M.; Audia, A.; Shi, J.; Songjian, L.; Bernstock, J.; Pavlyukov, M.S.; Das, A.; Kim, S.; Shin, Y.J.; Lee Y.; Koo, H.; Snigdha, K.; Waghmare, I.; Guo, X.; Mohyeldin, A.; Gallego-Perez, D.; Wang, J.; Chen, D.; Cheng, P.; Mukhee, F.; **Contreras, M.**; Reyes, J.F.; Vaillant, B.; Sulman, E.P.; Cheng, S.; Markert, J.M.; Tannous, B.A.; Lu, X.; Kango-Shingh, M.; Lee, L.J.; Na, D.; Nakano, I.; Bhat, K.P. Phenotypic Plasticity of Invasive Edge Glioma Stem-Like Cells in Response to Ionizing Radiation. *Cell Reports*. 2019. February. 26(7):1893-1905. https://doi.org/10.1016/j.celrep.2019.01.076.

Current Research (expanded description): Astrocytes are a type of glial cell, and an important function of these cells is the regulation of neuronal synaptic plasticity. The period in development when neural circuits are shaped by experience is termed the critical period. During the visual critical period, development of normal vision depends on proper visual input. Monocular deprivation, or the occlusion of sensory input to one eye, when performed during the critical period, leads to ocular dominance plasticity (ODP). ODP occurs when activity from the occluded eye is reduced, thereby allowing the open eye to take over the visual cortex territory of the occluded eye. Interestingly, introduction of juvenile astrocytes to the adult visual cortex reinduces ODP, suggesting a role for astrocytes in regulating critical period plasticity. Thus, ODP offers a reliable way to explore how changes in sensory experience lead to astrocyte regulation of neural circuit plasticity. To investigate this, response to monocular deprivation will be explored in mice where astrocytes undergo genetic manipulation during the critical period and adulthood, in addition to assessing synaptic activity and spine density. The proposed research will investigate the role astrocytes in regulating experience-dependent plasticity during the critical period and adulthood.

Benefits to Science and Society: The results obtained from my research project will lead to further understanding the molecular mechanisms that regulate experience-dependent plasticity. Further, it will identify whether immediate early genes in astrocytes play a regulatory role in response to experience-dependent neuronal activity resulting in an important contribution to understanding the internal molecular mechanisms of astrocytic regulation.

Personal Interests: When not in the lab, you may find me outdoors enjoying this beautiful San Diego weather with my wife and dogs. I love hiking, camping, going to the beach, and snorkeling.

ARCS Award: I am incredibly grateful and honored to be an ARCS Scholar. This recognition motivates me to continue my quest for new knowledge. It reminds me that even though my contribution to science might be a tiny piece of the complicated puzzle that is the brain, it is a piece that gets us closer to understanding the brain as a whole nonetheless.

WILFREDO GABRIEL GONZALEZ-RIVERA

University of California San Diego

Jacobs School of Engineering

Concentration: Bioinformatics and Systems Biology

Specialization: Precision Medicine

Donor: Ellen Browning Scripps Foundation

As a biomedical informatics PhD student at UC San Diego, Wilfredo is applying his multidisciplinary skills in genetics, genomics, and social sciences to study the influence of ancestry on the associations between genetic variation and complex traits, with a focus on admixture populations. Considering a patient's genetic variants can ultimately allow for the development of personalized treatments, which has the potential to positively impact worldwide health. Wilfredo's mission is to mitigate health disparities between individuals of underrepresented and diverse populations such as, Hispanic/Latinx communities with the vision of innovating medical utility of genetic information for all.

Degrees: B.S. Industrial Biotechnology, University of Puerto Rico, Mayaguez; B.S. Computer Science, University of Puerto Rico, Mayaguez

Awards and Honors: Alfred P. Sloan Fellowship Award, 2022; Competitive Edge Fellowship Award, 2022; UPRM Friedrich Gauss Medal for top student in Computer Science, 2021; NIH – Puerto Rico IDeA Network of Biomedical Research Excellence Fellowship, 2020

Publications, Papers, and Posters:

González-Rivera, W.; Yu, X.; Frazer, K.; D'Antonio, M.; Gymrek, M. Unraveling the Complexity of Social Descriptors and Genetic Variation in Precision Medicine. *ABRCMS.* 2023.

González-Rivera, W.; Woo-Yeong, P.; Frazer, K.; Gymrek, M.; D'Antonio, M. Local Ancestry-Aware Genotype Principal Component Analysis on Chronic Kidney Disease GWAS signals. *ASHG*. 2023.

González-Rivera, **W.**; Cruzado, J. A Panel of Ancestry Informative Markers to Determine the Ancestral Proportions of Puerto Ricans. *Latin American Association of Biological Anthropology*. 2022.

González-Rivera, **W.**; cGMP, cGLP and Chemical Safety Handling Inside an Analytical Laboratory. *Eli Lilly.* Carolina, Puerto Rico, 2021.

Current Research (expanded description): The combination of population descriptors and genomic variation in Genome Wide Association Studies (GWASs) has led several studies to consider local ancestry inference (LAI), which assigns population descriptors to individual chromosomal segments, to improve trait prediction in diverse and admixed individuals. However, other studies have suggested that in most cases, LAI methods do not improve the power to identify genomic loci associated with specific traits in an admixed population likely because labeling a segment in the chromosome as ancestry-specific to a population does not capture the genetic diversity of a locus. I propose to develop and apply a pan-ancestry GWAS approach, which leverages quantitative haplotype-based coordinates rather than traditional race or ethnicity labels, to improve the power of identifying genomic loci associated with complex traits in admixed populations. I am characterizing this novel set of quantitatively defined pan-ancestry haplotypes and using principal components (PCs) coordinates derived from these as input to GWASs to accurately identify and characterize association signals across diverse populations.

Benefits to Science and Society: My approach provides a pan-ancestry framework, opening up possibilities for unraveling genetic associations in diverse populations and enhancing our understanding of complex traits. Ultimately, my work aims to increase recognition of the importance of including underrepresented racial and ethnic groups in genomic research to improve the accuracy and generalizability of GWASs for all. The outcomes of this study hold immense potential for advancing admixture science, population genetics, and precision medicine, ultimately benefiting individuals from diverse ancestral backgrounds.

Personal Interests: I am interested in exploring the world around me and looking for nice coffee shops to enjoy reading or coding.

ARCS Award: My long-term career goal is to secure a tenured research position at a Hispanic Serving Institution (HSI), preferably the University of Puerto Rico, where I can integrate my expertise in genetics, genomics, and social sciences to untangle the complex factors contributing to health disparities among underrepresented racial and ethnic groups. I aspire to develop innovative methods, strategies, and tools to study admixture populations in science, making significant contributions to the field of bioinformatics and ensuring that it is inclusive, accurate, and applicable to diverse populations. Finally, I want to make graduate research accessible to the Puerto Rican community by establishing a scholarship for economically disadvantaged Puerto Ricans who wish to pursue graduate studies in the United States. As a first-generation, low-income student from Vega Baja, Puerto Rico, I am humbled and grateful for the support of the ARCS Foundation. The award means far more to me than its financial implications, representing the promise of a robust Hispanic/Latinx STEM community that has been underrepresented for many years. Thank you for your help and generosity. I look forward to contributing to making the world a better place.

RAYYAN MOHAMMED GORASHI

University of California San Diego

Jacobs School of Engineering

Concentration: Bioengineering

Specialization: Biomaterials and Sex-specific Disease Modeling

Donor: ARCS Foundation - San Diego Chapter

Rayyan's research leverages biomaterial tools to better understand sex differences in heart valve disease. Current treatments are limited to pharmaceutical drugs or invasive, total valve replacement procedures. Drug treatments are often ineffective for females due to an incomplete understanding of female-specific disease mechanisms. Rayyan utilizes biomaterials to create physiologically relevant disease models to study sex-specific mechanisms. More broadly, Rayyan seeks to understand the sex differences in heart valve disease progression to create more equitable treatment options for both male and female patients.

Degrees: M.S. in Biomedical Engineering, Northwestern University; B.S. in Chemical and Biomolecular Engineering, Johns Hopkins University

Awards and Honors: Jacobs School of Engineering Research Expo, Best Poster, Bioengineering, 2023; NIH NHLBI R00 Supplemental Fellowship to Support Diversity in STEM, 2022-2024; NHLBI T32 Training in Bioengineering, Cardiovascular Health & Disease, 2022; Jacobs School of Engineering Racial Equity Fellow, 2021-2022.

Publications, Papers, and Posters:

Gorashi, R.M.; Wenning, M.; Grim, J.; Walker, C.; Pena, B.; Mestroni, L.; Anseth, K.; Aguado, B. Sex-specific Valvular Myofibroblast Activation in Response to Nano-scale Stiffness Cues. Oral presentation. *Society for Biomaterials Annual Meeting*. San Diego, CA. April 2023.

Gorashi, R.M.; Rivera-Bolanos, N.; Dang, C.; Chai, C.; Kovacs, B.; Alharbi, S.; Ahmed, S. S.; Goyal, Y.; Ameer, G.; Jiang, B. Modeling Diabetic Endothelial Dysfunction with Patient-specific Induced Pluripotent Stem Cells. *Translational Medicine.* 2023. DOI:10.1002/btm2.10592.

Gorashi, R.M.; Félix Vélez, N. E.; Aguado, B. A. Chemical and Molecular Tools to Probe Biological Sex Differences at Multiple Length Scales. *Journal of Materials Chemistry.* B 2022, 10 (37), 7089–7098. DOI:10.1039/d2tb00871h.

Chan, X.Y.; Volkova, E.; Eoh, J.; Black, R.; Fang, L.; **Gorashi, R.M.**; Song, J.; Wang, J.; Elliott, M. B.; Barreto-Ortiz, S.F.; Chen, J.; Lin, B.L.; Santhanam, L.; Cheng, L.; Lee, F.S.; Prchal, J.T.; Gerecht, S. HIF2A Gain-of-Function Mutation Modulates the Stiffness of Smooth Muscle Cells and Compromises Vascular Mechanics. *iScience*. 2021, 24 (4), 102246. DOI:10.1016/j.isci.2021.102246.

Current Research (expanded description): Clinical evidence suggests aortic valve stenosis (AVS) progression is sexually dimorphic in disease presentation and outcomes. For example, male aortic valves tend to develop a calcified phenotype while female valves exhibit a distinct fibrotic phenotype. The calcified phenotype is characterized by stiff, spherical calcium-phosphate nanoparticles, where particle size and abundance increase with disease progression. Previous work also suggests that X-linked and Y-linked genes and epigenetic modifiers may contribute to sex dimorphisms in valve disease. My research utilizes photo-tunable, polyethylene glycol (PEG)-based biomaterials, to model healthy and diseased microenvironments. These physiologically relevant models will allow us to identify novel X-linked and Y-linked genes implicated in the pathogenesis of AVS. I will also utilize transcriptomics to gain a better understanding of how sex chromosome linked genes impact signaling pathways involved in AVS progression. Additionally, I will incorporate stem-cell based technology into the lab by reprogramming healthy and valve disease patient blood cells into stem cells to enhance the clinical relevance of our models. Together, I will create patient-specific models of AVS and validate X-linked and Y-linked genes as novel targets for sex-specific AVS interventions.

Benefits to Science and Society: The current landscape for noninvasive heart valve disease treatment is ineffective for females due to a lack of understanding of the biological disease mechanisms. My research aims to fill that gap in knowledge by delineating the sex differences in disease progression and presentation through biomaterials-based models. By incorporating sex as a biological variable into my research, I aim to create more equitable, sex-specific treatment options for heart valve disease patients.

Personal Interests: I enjoy nature/landscape and portrait photography, surfing, working out, video games, and spending time with family.

ARCS Award: I am deeply honored and grateful to have received the ARCS Foundation award. As graduate students, we often face financial barriers that impose additional stress and hardships on our work. The ARCS Foundation award will alleviate this stress and thus allow me to progress in my studies. Additionally, I thoroughly appreciate the ARCS Foundation's emphasis on community engagement and outreach, as this is a strong passion of mine. I feel incredibly thankful to be integrated into this wonderful community of fellow ARCS scholars and professionals. I look forward to expanding my network and growing both as a person and scientist alongside my peers.

SONYA RENEE HAUPT

University of California San Diego

Health Sciences

Concentration: Biomedical Sciences

Specialization: Immunology

Donors: Timkin-Sturgis Foundation/ARCS Foundation - San Diego Chapter

Sonya is researching novel technology to be used in HIV (human immunodeficiency virus) vaccines. She evaluates the immune response in model organisms to project what vaccination strategy will create broadly-neutralizing antibodies in humans. Her first project is developing a helper T cell epitope tag that can work across all human HLA types to boost germinal center education of antibody responses. Her second project is modeling how vaccines benefit from different components administered in each dose to progressively coach cells to evolve better neutralizing antibodies. Although HIV vaccines are not effective yet, she hopes that her contribution may help her see an approved HIV vaccine in our lifetime.

Degrees: M.S in Structural Biology in Molecular and Cellular Biology, University of Connecticut; B.S. in Molecular and Cellular Biology, University of Connecticut

Awards and Honors: University of Connecticut - Outstanding Senior in Molecular and Cellular Biology, 2016; University Scholar (1 of 28 selected) University of Connecticut, 2015; Life Sciences Honors Thesis Award Funding, University of Connecticut, 2014; Daniel Hand High School, Outstanding Achievement in Sciences, 2011

Publications, Papers, and Posters:

Dan, J.M.; Mateus, J.; Kato, Y.; Hastie, K.M.; Yu, E.D.; Faliti, C.E.; Grifoni, A.; Ramirez, S.I.; **Haupt, S.**; Frazier, A.; Nakao, C.; Rayaprolu, V.; Rawlings, S.A.; Peters, B.; Krammer, F.; Simon, V.; Saphire, E.O.; Smith, D.M.; Weiskopf, D.; Sette, A.; Crotty, S. Immunological Memory to SARS-CoV-2 Assessed for up to 8 Months after Infection. *Science.* 2021, 371 (6529), eabf4063. https://doi.org/10.1126/science.abf4063

Dooley, K.; McConnell, R.E.; Xu, K.; Lewis, N.D.; **Haupt, S.**; Youniss, M R.; Martin, S.; Sia, C. L.; McCoy, C.; Moniz, R.J.; Burenkova, O.; Sanchez-Salazar, J.; Jang, S.C.; Choi, B.; Harrison, R.A.; Houde, D.; Burzyn, D.; Leng, C.; Kirwin, K.; Ross, N.L.; Finn, J.D.; Gaidukov, L.; Economides, K.D.; Estes, S.; Thornton, J.E.; Kulman, J.D.; Sathyanarayanan, S.; Williams, D.E. A Versatile Platform for Generating Engineered Extracellular Vesicles with Defined Therapeutic Properties. *Mol Ther.* 2021, 29 (5), 1729–1743. https://doi.org/10.1016/j.ymthe.2021.01.020

Kato, Y.; Abbott, R. K.; Freeman, B. L.; **Haupt, S.**; Groschel, B.; Silva, M.; Menis, S.; Irvine, D. J.; Schief, W. R.; Crotty, S. Multifaceted Effects of Antigen Valency on B Cell Response Composition and Differentiation In Vivo. *Immunity.* 2020. https://doi.org/10.1016/j.immuni.2020.08.001

Lewis, N. D.; Sia, C. L.; Kirwin, K.; **Haupt, S.**; Mahimkar, G.; Zi, T.; Xu, K.; Dooley, K.; Jang, S. C.; Choi, B.; Boutin, A.; Grube, A.; McCoy, C.; Sanchez-Salazar, J.; Doherty, M.; Gaidukov, L.; Estes, S.; Economides, K. D.; Williams, D. E.; Sathyanarayanan, S. Exosome Surface Display of IL-12 Results in Tumor-Retained Pharmacology with Superior Potency and Limited Systemic Exposure Compared to Recombinant IL-12. *Mol Cancer Ther.* 2020, molcanther.0484.2020. https://doi.org/10.1158/1535-7163.mct-20-0484

Current Research (expanded description): While working in a biotechnology startup I fell in love with the interdisciplinary nature of making novel therapeutics. It was the first time I realized my academic background could transcend into translational research, where engineering advancements and tenants of biology must be expertly blended to create the next wave of medicines. When I returned to graduate school and the world of academic science, I was drawn to this interface of what we know and what we can do with it in Dr. Shane Crotty's lab. Dr. Crotty and his lab have been large contributors to understanding germinal center dynamics as they relate to the body's adaptive immune response to vaccines. Along with his collaborators, I have joined the effort to engineer and evaluate novel antigens, dosing regimens, delivery systems, and adjuvants as components in an effective HIV vaccine. While the fight to make a HIV vaccine has been ongoing for some time, new hope was ignited in 2009 with the discovery that some long-term infected HIV patients were able to make broadly neutralizing antibodies. How to create this antibody response in unexposed individuals with only a few vaccine doses is what our lab models in mice and non-human primates.

Benefits to Science and Society: Vaccines have proven to be the most effective medical technology for improving global health. As preventative and single use medicines they are easy to administer to populations of all socio-economic levels. In the case of polio, they were so effective as to eradicate the disease entirely. Yet some extremely advanced pathogens overcome common vaccination strategies. Such is the case with HIV (human immunodeficiency virus) which infects 1.5 million people every year and becomes a life long infection, ultimately killing almost 1 million people per year as of 2020.

Personal Interests: I enjoy mentally challenging exercise and connecting with others. I have found such with ultimate frisbee and outdoor rock climbing.

ARCS Award: I am extremely honored to get this award. I am excited to attend events and learn from and about other members. Being an ARCS awardee has made me think about how I can contribute to maintaining a healthy scientific culture in the US along with a healthier global population. Additionally, female leadership and empowerment are topics near to my heart and so I value that this foundation is one more example of that!

NATHANIEL MAX KLEVIT HOPKINS

University of California San Diego

Jacobs School of Engineering

Concentration: Computer Science and Engineering

Specialization: Theoretical Computer Science

Donor: Kathryn Crippen Hattox Endowment

From measurements of the largest galaxies to the smallest proteins, scientists now record more data in a day than they can possibly handle in a lifetime. This has led to a modern-day scientific revolution, where data-hungry machine learning techniques are used to attack age-old problems like protein folding. These applications, however, require data annotated by people, which is prohibitively expensive for applications like computer-assisted medical diagnosis. Max's research focuses on the theory behind how easily-accessible raw data combined with a few enriched annotations can significantly reduce otherwise infeasible labeling costs.

Degree: B.A. in Mathematics, Harvard University

Awards and Honors: National Science Foundation GRFP Award 2018, JSOE Fellowship 2018, Phi Beta Kappa 2017, United States Presidential Scholar 2014

Publications, Papers, and Posters:

Hopkins, M.; Lin, T. Explicit Lower Bounds Against Ω(n)-Rounds of Sum-of-Squares. *2022 Symposium on Foundations of Computer Science.*

Bafna M.; **Hopkins, M.**; Kaufman T.; Lovett, S. Hypercontractivity on High Dimensional Expanders: a Local-to-Global Approach for Higher Moments. *2022 Symposium on Theory of Computing.*

Hopkins, M.; Kane, D.; Lovett, S. Mahajan G. Point Location and Active Learning: Learning Halfspaces Almost Optimally. *2020 Symposium on Foundations of Computer Science.*

Current Research (expanded description): Given a set of n unlabeled data points and query access to an oracle labeling them, how many questions are required to label all n points? This fundamental question lies at the heart of active learning, a field which aims to use adaptivity to exponentially reduce the number of labeled samples required for machine learning. If our n points can be labeled arbitrarily, the answer to this question is of course n—we must query every point. On the other hand, if we are promised the underlying labeling has some structure, one might hope it could be leveraged to use only log(n) adaptive questions.

Unfortunately, it turns out that in the standard model this is impossible, even for basic structures. My research focuses on breaking this barrier by asking more informative questions beyond labels (e.g., by comparing points). In a series of works, my collaborators and I have shown optimal algorithms for learning under a number of reasonable structures such as halfspaces, rectangles, decision trees, and polynomial threshold functions via access to natural enriched queries. Applying these results to standard learning paradigms gives query-efficient learners that never make an error (though they may occasionally respond "I don't know").

Benefits to Science and Society: Many important real-world applications of machine learning are hampered by the fact that labeling data is infeasibly expensive. My research suggests that this is not an inherent barrier, and that by developing natural application-specific questions, it may be possible to harness powerful supervised learning techniques without the associated cost. Since our algorithms are additionally more reliable than standard techniques, we hope they can find use in important high-risk applications like preventative medicine and computer-assisted diagnoses.

Personal Interests: In my free time I sing acapella and barbershop music and enjoy pretty much every form of game.

ARCS Award: I am humbled and thankful for the support of the ARCS Foundation. To me, the award means far more than its financial implications alone. ARCS is the promise of a robust scientific community, and the recognition of years of hard work that could often feel thankless in the face of failure and rejection. I am honored to be counted among its members, and excited to see what the community has in store.

PRATIBHA JAGANNATHA

University of California San Diego

Jacobs School of Engineering

Concentration: Bioinformatics and Systems Biology

Specialization: RNA Biology

Donor: Virginia Lynch Grady Endowment

The central dogma of biology states that RNA converts information stored as DNA sequences, a process called transcription, into proteins, a process called translation. RNA isoforms result from the same DNA sequences being transcribed into different RNA sequences. RNA isoforms are essential for proper functioning of neurons, highly regulated cells of the nervous system, and help support its unique morphology. Using computational and experimental approaches and third generation sequencing, Pratibha studies the relationship between RNA isoforms and translation in the context of normal cellular processes and disease development in neurons.

Degree: B.S. in Biomolecular Engineering, University of California Santa Cruz

Awards and Honors: National Science Foundation GRFP Honorable Mention 2020

Publications, Papers, and Posters:

Robinson, E.K.; **Jagannatha, P.**; Covarrubias, S.; Cattle, M.; Smaliy, V.; Safavi, R.; Shapleigh, B.; Abu-Shumays, R.; Jain, M.; Cloonan, S.M.; Akeson, M.; Brooks, A.N.; & Carpenter, S. Inflammation Drives Alternative First Exon Usage to Regulate Immune Genes Includinga Novel Iron-Regulated Isoform of Aim2. *2021, eLife.* 10, e69431. https://doi.org/10.7554/eLife.69431

Brannan, K.W., Chaim; I.A.; Marina, R.J.; Yee, B.A.; Kofman, E.R.; Lorenz, D.A.; **Jagannatha**, **P.**; Dong, K. D.; Madrigal, A.A.; Underwood, J.G.; & Yeo, G.W. Robust Single-Cell Discovery of RNA Targets of RNA-Binding Proteins and Ribosomes. *Nature Methods.* 2021, 18(5), 507–519

Current Research (expanded description): mRNA isoforms of a transcript set can have varying sequence and structural features which may, in turn, lead to complex and differing translational control and ultimately, translation. Isoform diversity is essential for numerous biological processes and has been implicated in multiple pathologies. It is particularly important in the context of the nervous system, with each neuron executing tight spatial and temporal regulation of translation. Variations in 5′ and 3′ untranslated region (UTR) sequences can lead to alterations in translation efficiency, often through cis-regulatory elements that can serve as binding sites for translation initiation factors and RNA binding proteins (RBPs). Additionally, variations to the coding sequence (CDS) can result in different proteins. The relationship between isoform diversity and translation still remains relatively unexplored. My research focuses on using third generation sequencing technologies, high throughput screening, and computational methods to elucidate the relationship between isoform diversity and translation. While my research is focused on understanding this relationship in the cell-type specific context of neuronal activation, my goal is for the methods and analysis pipelines I develop to be applied to studying other conditions and cell types.

Benefits to Science and Society: Isoform diversity is a critical component of many biological processes and has been implicated in multiple pathologies in neurons and other cell types. Understanding the relationship between RNA isoform diversity and translation can not only add to our understanding of relevant biological mechanisms and disease progression, but also help provide an avenue for the development of novel therapeutic strategies.

Personal Interests: I enjoy singing, dancing, painting, and watching documentaries. I also enjoy participating in outreach and mentoring programs.

ARCS Award: I am very grateful to have received the ARCS Foundation award. It has allowed me to focus on pursuing my research endeavors and to dedicate more time towards my outreach and mentoring activities. I am honored to be a part of such an incredible community of scientists and supportive individuals who appreciate science.

WADE TRUMAN JOHNSON

University of California San Diego

Jacobs School of Engineering

Concentration: Nanoengineering

Specialization: Immune Engineering and Biomaterials

Donors: Kurt Benirschke Family/ARCS Foundation - San Diego Chapter

Wade's research focuses on the development of nanoscale biomaterials to control flares in patients with chronic autoimmune diseases. The standard of care treatment for inflammatory flares is corticosteroids. Unfortunately, these treatments do not prevent flare recurrence, are associated with potent side effects, and reduce the body's natural ability to fight off infections and cancer. The biomaterials Wade develops are designed to prevent flare-ups by inducing a protective immune cell subset in a targeted area without systemically hampering the body's immune system to fight off disease.

Degrees: M.S. in Nanoengineering, University of California, San Diego; B.S. in Chemistry, University of California, Santa Barbara

Awards and Honors: Diversity Champion Award, University of California San Diego, 2023; NIAMS Training Grant, University of California San Diego, 2023-2021; Nanoengineering Department Fellowship, University of California San Diego, 2020; Regents Scholarship, University of California Santa Barbara; 2013.

Publications, Papers, and Posters:

Johnson, W.T.; McBride, D.A.; Kerr, M.D.; Nguyen, A.; Zoccheddu, M.; Bollmann, M.; Wei, X.; Jones, R. M.; Wang, W.; Svensson, M.; Bottini, N.; Shah, N.J. Immunomodulatory Nanoparticles for Modulating Arthritis Flares. *ACS Nano*. 2023. (In revision)

McBride, D.A.; Kerr, M.D.; **Johnson, W.T.**; Nguyen, A.; Zoccheddu, M.; Yao, M.; Prideaux, E.B.; Dorn, N.C.; Wang, W.; Svensson, M.; Bottini, N.; Shah, N.J. Immunomodulatory Microparticles Epigenetically Modulate T cells and Systemically Ameliorate Autoimmune Arthritis. *Adv. Sci.* 2023, 10 (11), 2202720. DOI:10.1002/advs.202202720

Kerr, M.D.; McBride, D.A.; **Johnson, W.T.**; Chumber, A.; Najibi, A.; Seo, B.; Stafford, A.; Scadden, D.; Mooney, D.; Shah, N.J. Immune-responsive Biodegradable Scaffolds for Enhancing Neutrophil Regeneration. *Bioeng. & Trans. Med.* 2022, 8 (1), e10309. DOI:10.1002/btm2.10309

Johnson, W.T.; Dorn, N.C.; Ogbonna, D.; Bottini, N.; Shah, N.J. Lipid-based Regulators of Immunity. *Bioeng. & Trans. Med.* 2021, 7 (2), e10288. DOI:10.1002/btm2.10288

Current Research (expanded description): Disease-modifying anti-rheumatic drugs (DMARDs) have been transformative for the treatment of inflammatory arthropathies including rheumatoid arthritis. However, recurring disease fluctuations in the joint, referred to as flares, can be a common experience. There are no therapies for flare control. Current treatments are focused on symptomatic relief with steroids. However, symptomatic control is ineffective at preventing flare recurrence and progressive irreversible joint damage. An unmet need exists for a durable flare control agent that could also complement standard-of-care DMARDs. To address this unmet need, I formulated an agent that facilitates joint-specific immunomodulation. The agent consisted of a bio-degradable nanoparticle (NP) generated from a maleimide functionalized co-polymer (PLGA-PEG-MAL), conjugated with N-terminal cysteine-modified immunodominant joint-relevant peptide derived from aggrecan (Agg) or collagen (bC2). Subsequently, calcitriol, a small molecule immunomodulatory hormone, was encapsulated in PLGA-PEG-MAL NP (CLNP) by nanoprecipitation. The resulting CLNP, termed Agg-CLNP and bC2-CLNP, were tested in two murine models of arthritis. In the SKG and collagen-induced arthritis mouse models of inflammatory arthritis, intra-muscular injection of Agg-CLNP and bC2-CLNP respectively protected against flares as assessed by reduced clinical scores, bone erosions and cartilage proteoglycan loss. The flare-protective effect was not associated with generalized immunosuppression.

Benefits to Science and Society: Autoimmune diseases affect millions across the lifespan and have complicated pathologies that are difficult to treat without broad immunosuppression. Debilitating flare-ups continue in a large fraction of patients during an otherwise quiescent, controlled disease state. The antigen-specific immunomodulation research I am conducting provides a pathway to treat diseases with complex pathologies without leaving patients vulnerable to disease. This will inspire research for other disease targets and provide patients with improved quality of life and peace of mind.

Personal Interests: I spend my time outside as often as possible, whether that be backpacking, sailing, or golfing.

ARCS Award: The ARCS foundation award is a great honor to receive and motivates me to continue my goal of making as positive an impact on the world as I can. This award validates that the research I am conducting has huge potential to impact and improve the lives of patients. I look forward to continuing my work, connecting with the ARCS community, and making real-world achievements.

NISHTA KRISHNAN

University of California San Diego

Jacobs School of Engineering

Concentration: Nanoengineering

Specialization: Immunology and Drug Delivery

Donor: The Reuben H. Fleet Foundation

Nishta's research focuses on cell membrane-coating nanotechnology, in which cell membrane is derived from live cells and coated onto the surface of synthetic nanoparticulate cores. In particular, Nishta is developing the next generation of these nanoparticles via genetic modification of the source cells. By introducing proteins onto the nanoparticle surface, she can integrate new capabilities and better address challenges in cancer therapy. She uses these genetic engineering approaches to develop nanoparticles with enhanced functionalities including improved targeting to disease sites, enhanced cellular entry, and superior biointerfacing capabilities.

Degrees: M.S. in Nanoengineering, University of California, San Diego; B.S. in Nanoengineering, University of California, San Diego

Awards and Honors: National Science Foundation Graduate Research Fellowship, 2020-2023; UCSD Gordon Scholars 2019-2020; UCSD Social Innovation Fund 2016-2017

Publications, Papers, and Posters:

Krishnan, N.; Jiang, Y.; Zhou, J.; Mohapatra, A.; Peng, F.; Duan, Y.; Holay, M.; Chekuri, S.; Guo, Z.; Gao, W.; Fang, R.; Zhang, L. A Modular Approach to Enhancing Cell membrane-coated Nanoparticle Functionality Using Genetic Engineering. *Nature Nanotechnology*. 2023, in press.

Krishnan, N.; Peng, F.; Mohapatra, A.; Fang, R.; Zhang, L. Genetically Engineered Cellular Nanoparticles for Biomedical Application. *Biomaterials*. 2023, 296, 122065.

Krishnan, N.; Kubiatowicz, L.; Holay, M.; Zhou, J.; Fang, R.; Zhang, L. Bacterial Membrane Vesicles for Vaccine Applications. *Adv. Drug Deliv. Rev.* 2022, 185, 114294.

Krishnan, N.; Fang, R.; Zhang, L. Engineering of Stimuli-responsive Self-assembled Biomimetic Nanoparticles. *Adv. Drug Deliv. Rev.* 2021, 179, 114006.

Current Research (expanded description): My research focuses on cell membrane-coating nanotechnology, where plasma membrane is derived from cells and coated onto a nanoparticulate core. Through this process, we imbue the resulting formulation with specific capabilities of the source cell, such as long circulation or pathogen binding. Cell membrane coated nanoparticles can also be used as a vaccine by presenting disease-relevant antigens to train the immune system. In my research, I am building the next generation of cell-membrane coated nanoparticles by using genetic engineering to introduce novel capabilities beyond what can be offered by wild-type cell membrane. These genetic engineering approaches can be used to add active targeting mechanisms to improve localization to the disease site, reduce off-target effects and enhance the performance of therapeutic formulations. In my future research, I plan to continue development of these genetically modified cell membrane-coated nanoparticles to offer enhanced utility across a wide range of biomedical applications.

Benefits to Science and Society: Current cancer treatments are often a blunt tool which result in strong adverse effects and a lowered quality of life for patients. By leveraging cell-membrane coating nanotechnology, we aim to develop safe and effective formulations that can be used against a variety of cancer types. Imbuing these nanoparticles with additional capabilities through genetic engineering has the potential to generate an incredibly powerful and flexible platform that can accommodate for a rapidly changing disease environment.

Personal Interests: I enjoy board games, learning aerial skills and eating otter pops!

ARCS Award: The ARCS Foundation award has given me the opportunity to join a community of researchers from a large set of disciplines. I'm incredibly grateful and honored to be a part of this network of scholars.

SAHANA KUTHYAR

University of California San Diego

Division of Biological Sciences

Concentration: Ecology, Behavior, and Evolution

Specialization: Microbial Ecology

Donor: ARCS Foundation – San Diego Chapter

Sahana studies how ecological and evolutionary factors impact the ability of animal-associated commensal microbes to prevent pathogen colonization. She uses domestication as a framework to explore how genetics and local ecology shape these phenomena. Her research seeks to understand under which contexts the gut microbiome of domestic animals defends against infectious disease. Her work will permit us to develop microbially minded interventions to manage infections and improve the productivity of animal rearing.

Degrees: M.S. in Environmental Sciences, Emory University; B.S. in Environmental Sciences, Emory University

Awards and Honors: Quantitative Integrative Biology Training Grant, 2021-2023; Biology EDI grant, 2023; Jeanne Marie Messier Memorial Award, 2021; Civic Engagement Microgrant, Research America, 2021

Publications, Papers, and Posters:

Kuthyar, S.; Watson, K.; Huang, S.; Brent, L.; Platt, M.; Horvath, J.; Gonzalez, J.; Knight, R.; Dominguez-Bello, M.G.; Amato, K.R. Limited Microbiome Differences in Captive and Semi-wild Primate Populations Consuming Similar Diets. *FEMS Microbiology Ecology.* 2022.

Kuthyar, S.; Reese. A.T. Variation in Microbial Exposure at the Human-animal Interface and Its Risks for Health. *mSystems*. 2021.

Kuthyar, S.; Kowalewski, M.M.; Roellig, D.M.; Mallott, E.K.; Zeng, Y.; Gillespie, T.R.; Amato, K.R. The Effect of Habitat Fragmentation and Giardia Intestinalis Infection on the Alouatta caraya Gut Microbiota. *Ecology and Evolution.* 2021.

Kuthyar, S.; Manus, M.; Amato, K.R. Leveraging Non-human Primates for Exploring the Social Transmission of Microbes. *Current Opinion in Microbiology*. 2019.

Current Research (expanded description): Understanding why domestic animals harbor such high burdens of emerging infectious diseases and multidrug resistance is critical not only to promote their performance and health but also to protect human health as domestic animals are amplifiers of emerging pathogens. Traits of individual animals, such as immunity, as well as features of their environment can mediate their likelihood of being infected or spreading infection. Compared to wild animals, the unique environment domestic animals experience, with altered diets and microbial exposures, as well as human interventions through veterinary care and artificial selection is therefore likely to play a critical role in determining their immune state and resulting disease burden. There is mounting evidence that the gut microbiome is a pathway connecting the environment and animal immunity. I use a combinatorial approach of observational data, in vitro experiments, and bioinformatics to 1) evaluate the relative contributions of genetics and local ecology on the gut microbiome and immune state across wild-domestic pairs, 2) test under which animal backgrounds and resident microbial taxa mediate microbiome-mediated colonization resistance, and 3) assay treatments to improve colonization resistance of domestic animal gut microbiomes.

Benefits to Science and Society: Understanding under which environmental contexts the gut microbiome defends against infectious disease can improve animal performance and resilience. Results from my research will provide foundational knowledge about how sub-therapeutic antibiotic use impacts microbiome-mediated colonization resistance, allowing future work to develop safer alternatives to prophylactic antibiotic treatment and growth promotion. More broadly, my research will determine if domestication has consistently altered the way animal-associated microbial communities interact with pathogens, permitting us to develop microbially minded interventions to manage infections and improve the productivity of animal rearing.

Personal Interests: I enjoy running, dancing, and generally being outdoors.

ARCS Award: I am honored and humbled to receive the ARCS Foundation award. Starting my PhD at the beginning of the pandemic has been an incredibly difficult, albeit rewarding, time, and I am excited to be part of the ARCS Foundation community. Importantly, receiving this award is a symbol that my work truly matters, further motivating me to promote solutions to manage infections in both animals and humans.

ARAZ MAJNOONIAN

University of California San Diego

Herbert Wertheim School of Public Health and Human Longevity Science

Concentration: Global Health

Specialization: Gender-Based Violence Prevention

Donors: Dr. Patricia Judd/ARCS Foundation - San Diego Chapter

Araz is conducting pioneering research to evaluate domestic violence support services nationwide in Armenia. Her study, the first of its kind in the country, adopts a participatory approach involving survivors of violence, domestic violence support center staff, and partner organizations to assess the impact and accessibility of these services. By generating evidence-based insights and recommendations, her research aims to enhance support for survivors and inform policy and practice. Her work contributes to the global fight against gender-based violence, offering valuable lessons for low and middle-income countries.

Degree: B.S. in Public Health, University of California San Diego

Awards and Honors: UC San Diego Sanford Institute for Empathy and Compassion, Technology Pilot Seed Research Grant, 2023; San Diego Center for AIDS Research Supporting and Uplifting New and Diverse Scientists in HIV Fellowship, UC San Diego, 2022-2023

Publications, Papers, and Posters:

Majnoonian, A.; Wijaya, C.; Fielding-Miller, R. Scripting Sexual Consent: a Pilot Study of a Sexual Wellness App Among College Students. Poster presentation. *Center for Empathy and Technology Research Jamboree*, La Jolla, CA. September 2023.

McDougal, L.; **Majnoonian, A.**; Stone, G.; Fielding-Miller, R. Determinants of Parent-reported Child Mental Health Status in San Diego Public Schools During the Height of the COVID-19 Omicron Outbreak: A Serial Cross-sectional Study. *PLOS ONE*. 2023, 18 (7), https://doi.org/10.1371/journal.pone.0288628

Vo, A.; **Majnoonian, A.**; Ni, J.; Hassani, A.; Wijaiya, C.; Duong, D.; Nguyen, M.; Flores, M.; Omaleki, V.; Le, T.; Fielding-Miller, R. Challenges of COVID-19 Case Investigation and Contact Tracing in School Settings. *Journal of School Health*. 2023, 93(5): 353–359

Majnoonian, A.; Vo, A.; Fielding-Miller, R. COVID-19 Crisis Communication in School Settings. Oral presentation. *American Public Health Association Annual Meeting and Expo.* October 2021.

Current Research (expanded description): I am currently working collaboratively with a non-governmental organization in Armenia to evaluate domestic violence support services nationwide. The project includes process, impact, and outcome evaluations to identify gaps and improve procedures, ensuring better responses, justice, and social protection for survivors. Using community-based participatory evaluation, we aim to co-create a conceptual framework for evaluating support services, ensuring that both survivor-defined and system-defined goals are addressed. This involves a participatory process that actively engages community stakeholders, support center staff, and survivors of domestic violence.

The evaluation will assess the effectiveness, accessibility, and impact of support services on domestic violence survivors. We will utilize a mixed-methods participatory approach, combining quantitative and qualitative data collection and analysis techniques to capture the perspectives of survivors, staff, and stakeholders. We aim to disseminate our findings and recommendations widely to policymakers, government agencies, NGOs, and the broader community. Through this research, we hope to contribute significantly to understanding the complexities of domestic violence support services, ultimately improving the lives of survivors and informing policies and programs in Armenia and other low and middle income countries.

Benefits to Science and Society: This research contributes to science and society by introducing a comprehensive evaluation framework for domestic violence support services, utilizing participatory methodologies. By adopting a community-based participatory research approach, this research fosters collaboration, strengthens local capacities, and generates evidence that can inform policy, empower survivors, and contribute to the broader global understanding of effective strategies for combating gender-based violence in diverse cultural contexts. The research benefits society by enhancing the quality and relevance of support services for domestic violence survivors in Armenia.

Personal Interests: I advocate for indigenous rights and cherish outdoor adventures: hiking, camping, and traveling.

ARCS Award: I am honored to be selected as a recipient of the ARCS Foundation award. As an Armenian woman, first-generation scholar, and immigrant, this recognition means the world to me. It represents not only financial support but also a validation of my journey and the potential impact of my work. Throughout my academic path, I've encountered various challenges, from navigating a new country's educational system to overcoming financial barriers. The generous support from organizations like the ARCS Foundation has been instrumental in overcoming these obstacles and reaching where I am today.

JOSHUA MANALO MESFIN

University of California San Diego

Jacobs School of Engineering

Concentration: Bioengineering

Specialization: Tissue Engineering and Bioinformatics

Donor: The Reuben H. Fleet Foundation

Josh's research focuses on utilizing and understanding the effects of injectable therapeutic biomaterials to treat the heart after a heart attack. After a patient undergoes a heart attack, there are very few treatments to prevent scar tissue that forms around the heart, which can lead to eventual heart failure and death. By using a therapy that can molecularly mediate the heart tissue and prevent scarring, Josh hopes to fully understand how these biomaterials mechanistically work via pre-clinical heart attack models, improve upon these biomaterials, and ultimately bring these treatments to the clinic.

Degree: B.S. in Biological Engineering, Massachusetts Institute of Technology

Awards and Honors: Siebel Scholar, 2023; AHA Predoctoral Fellowship, 2022; National Science Foundation Graduate Research Fellowship, Honorable Mention, 2021; Ford Foundation Fellowship Honorable Mention, 2021.

Publications, Papers, and Posters:

Mesfin, J.M.; Ninh, V.K.; Wong E.G.; Diaz, M.D.; Wang, R.M.; Karkanitsa, M.L.; Hunter, J.D.; Chen, A., Yu, J.; Pham, J.A.; Taghdiri, N.; Calcagno, D.M.; Luo, C.G; Braden, R.L.; Fu, Z.; King, K.R.; Christman, K.L. Uncovering the Specific Mechanisms Governing Injectable Myocardial ECMs in MI through Single Nuclei and Spatial Transcriptomics. *TERMIS-AM.* 2023 April 11-14, Boston, MA.

Mesfin, J.M.,; Carrow, K.P.; Chen, A.; Wong, E.G.; Zelus, E.I.; Hunter, J.D.; Luo, C.G.; Gianneschi, N.C.; Christman, K.L. Use of a Keap1-inhibiting Peptide Brush Polymer for Myocardial Infarction Treatment. *Society of Biomaterials .* 2023 April 19-22, San Diego, CA.

Wang, R.M.; **Mesfin, J.M.**; Karkanitsa, M.L..; Zelus, E.I.; Ungerleider, J.; Kawakami, Y.; Kawakami, Y.; Kawakami, T.; Christman, K.L.. Immunomodulatory Contribution of Mast Cells to the Biomaterial Microenvironment. *NPJ Regenerative Medicine.* 2023.

Mesfin, J.M.*; Chen, A.*; Gianneschi, N.C.; Christman, K.L. Intravascularly Infusible Biomaterials to Treat Myocardial Infarction. *Advanced Materials*. 2023.

*Denotes co-first authors.

Current Research (expanded description): My research entails studying the mechanism behind both natural and synthetic biomaterials to treat the heart post myocardial infarction (MI), otherwise known as a heart attack. Our lab has created a left-ventricle derived myocardial matrix hydrogel that has shown safety in both animal models and within patients. However, we wish to fully characterize this biomaterial and the cells the material interacts with via single cell gene expression studies. In my lab, I currently utilize novel transcriptomic tools to understand our myocardial matrix hydrogel's effect on the heart through cellular gene expression and spatial gene expression when our material is injected into the heart post-MI. In addition, I am using my knowledge uncovered from transcriptomics in the heart to create nanomaterials with the help of the Gianneschi Lab at Northwestern University. These nanomaterials behave like proteins, and can be delivered intravenously, allowing for a minimally invasive approach to treat the heart after MI. Thus, I plan to fully characterize different biomaterials on their therapeutic effect post-MI to thus improve upon the direct treatments for MI.

Benefits to Science and Society: With the exception of organ transplantation, there is no cure for myocardial infarction. Treatments for myocardial infarction also remain severely limited. By studying the effects of novel biomaterials which have demonstrated a therapeutic effect in past publications, we can uncover the direct molecular mechanism behind each biomaterial and thus improve upon these biomaterials to have a more pronounced therapeutic effect for patients suffering from myocardial infarction and cardiovascular disease. Finally, my research is aimed at laying the groundwork for creating a systemically injectable biomaterial that targets and treats the heart as soon as a patient suffers from MI.

Personal Interests: I enjoy traveling, baking, and cooking. I'm also a fan of board/video games and finding things I haven't tried.

ARCS Award: I am incredibly blessed to have been selected as an ARCS Scholar. The support from this award will provide me with opportunities for networking and advancing as a professional. I look forward to the opportunities that I will gain in terms of science communication and community engagement. The ARCS award will allow me to continue inspiring others to pursue science, knowledge, and clinical impact. I am also honored to be a part of a supportive community that encourages me to think bigger and keep moving forward.

DANIEL MILSHTEYN

University of California San Diego

Physical Sciences

Concentration: Chemistry and Biochemistry

Specialization: Lipid Biochemistry and Biophysics

Donor: ARCS Foundation - San Diego Chapter

Daniel studies the regulation of negatively curved lipids in cell membrane dynamics and environmental adaptation. His primary research focuses on the biophysical roles of cholesterol in mitochondrial fission driven by multi-organelle contacts. In addition, he collaborates with scientists from the Extreme Biophysics Research Coordination Network to understand the roles of lipids in adapting model organisms to survive in deep-sea or high-pressure environments. Daniel is training in interdisciplinary approaches including super resolution live-cell microscopy, membrane biophysics, and synthetic biology to understand the implications of lipid composition across scales from cell membranes to organismal physiology and disease.

Degrees: M.S. in Chemistry, University of California, San Diego; B.S. in Biomolecular Engineering, University of California, Santa Cruz

Awards and Honors: Graduate Research Fellowship Program Honorable Mention, National Science Foundation 2022; Interfaces Graduate Training Grant 2021-2023; San Diego Fellow 2022.

Publications, Papers, and Posters:

Milshteyn D.; Winnikoff J.R.; Haddock S.H.D; Budin I. Biophysical Adaptations of Cell Membranes to Hydrostatic Pressure: from Deep-sea Marine Invertebrates to Model Microorganisms. *Biophysical Society Conference*. San Diego, CA. 2023.

Moore W.M.; **Milshteyn D**.; Tsai Y.T.; Budin I. Engineering the Bilayer: Emerging Genetic Toolkits for Mechanistic Lipid Biology. *Curr. Op. in Chemical Biology.* 2021, 65, 66-73.

Milshteyn D.; Cooper G.; Deamer D. W. Chemiosmotic Energy for Primitive Cellular Life: Proton Gradients are Generated Across Lipid Membranes by Redox Reactions Coupled to Meteoritic Quinones. *Scientific Reports.* 2019, 9(1).

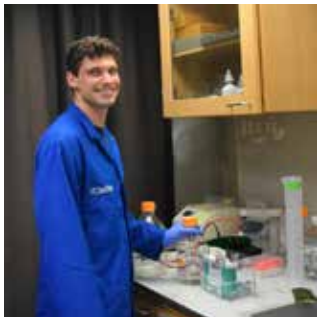
Milshteyn, D.; Damer, B.; Havig, J. R.; Deamer, D. W. Amphiphilic Compounds Assemble into Membranous Vesicles in Hydrothermal Hot Spring Water but Not in Seawater. *Life*. 2018, 8 (2), 11.

Current Research (expanded description): Unique organelle properties, dynamics, and interactions are established by their membranes' specific lipid compositions. Cholesterol is a major component of mammalian diet and physiology, yet little is known about its contributions to mitochondrial dynamics, in which mitochondrial network fission and fusion rates are balanced for a cell's energy production. Recent studies have implicated proteins involved in the exchange of phospholipids between multiple organelles preceding mitochondrial fission, but the involvement of cholesterol in this process has not yet been demonstrated. Knockdown of Arf1 in trans-golgi network vesicles and Orp1L in lysosomes, proteins that are both involved in the exchange of cholesterol for phosphatidylinositol 4-phosphate (PI4P) between organelle membranes, caused hyperfused mitochondria with inhibited fission. Studying the roles of sterols and PI4P in mitochondrial membranes may provide an insight into understanding how cells regulate and meet metabolic needs. By employing methods across membrane biophysics, cell biology, and protein biochemistry, I am investigating the importance of cholesterol in mitochondrial membranes, its biophysical contributions to membrane fission, and how dysregulation of mitochondrial cholesterol may impact human health. In addition, I study how deep-sea organisms adapt to the crushing hydrostatic pressures found descending down to the bottom of the ocean. Collaborating with biophysicists and marine biologists, I metabolically engineer the production of lipid biomarkers detected in deep-sea comb jellies into laboratory bacteria and yeast model microorganisms. By growing these engineered microorganisms in high-pressure chambers, I assay what lipids help confer survival and growth in high-pressure environments. To understand the biophysical mechanisms by which lipids aid in this adaptation, I employ lipidomics and Small Angle X-ray Scattering to uncover fundamental lipid properties that can then be generalized and applied to understanding cellular biology and organismal physiology.

Benefits to Science and Society: Lipids are an understudied macromolecule, when compared to the body of knowledge encompassing proteins and DNA. Conducting fundamental research in the biochemistry and biophysics of membranes within the context of mitochondrial fission and environmental adaptation may have broader impacts on treating metabolic diseases and understanding the effects of climate change on marine organisms, respectively.

Personal Interests: In my free time, I enjoy listening to music, getting lost in nature, and roller skating.

ARCS Award: It is an immense privilege and honor to be named an ARCS Scholar. Receiving the award is both humbling and empowering, motivating me to continue pursuing my passions in scientific research. Being recognized as an ARCS Scholar connects me to a network of individuals within the scientific and local communities that are dedicated to benefiting science and society through their support of research and education. I hope to take advantage of this network and the opportunities it provides to grow as an individual and scientist, and to then contribute back to my communities through mentorship, outreach, and scientific advancement.



CHIAKI ISABELA SANTIAGO

University of California San Diego

Division of Biological Sciences

Concentration: Neurosciences

Specialization: Cellular and Molecular Neurosciences

Donor: Elizabeth Taft

Chiaki's thesis project aims to understand the molecular mechanisms that drive experience-dependent circuit plasticity in the mammalian brain. The animal brain extracts salient information from its environment, generating memories and behavioral adaptations that allow it to survive in a complex world. This is done through the activity of excitatory and inhibitory neurons that are organized into synaptically connected circuits. Chiaki studies how experience, through the execution of activity-dependent gene expression, regulates the connections between excitatory and inhibitory neurons, and how these processes relate to animal behavior and disease states.

Degrees: M.S. in Neurosciences, University of California, San Diego; B.S. in Neurosciences, Vanderbilt University

Awards and Honors: Community Leadership Award, 2022; National Science Foundation Graduate Research Fellowship, Honorable Mention, 2021; Ford Foundation Pre-doctoral Fellowship, Honorable Mention 2021; University of California, San Diego Competitive Edge Fellowship, 2019.

Publications, Papers, and Posters:

Sibener, L.J; Kirchgessner, M.A; Steiner, S.; **Santiago, C.I.**; Cassataro, D.; Rossa, M.; Profaci, C.P.; Padilla-Coreano, N. Lessons from the Stories of Women in Neuroscience. *J. Neuroscience.* 2022, 2(24):4769-4773. DOI: 10.1523/JNEUROSCI.0536-22.2022.

Joffe ,M.E.*; **Santiago, C.I.***; Engers, J.L.; Lindsley, C.W.; Conn, P.J. Frontal Cortex Genetic Ablation of Metabotropic Glutamate Receptor Subtype 3 (mGlu3) Impairs Postsynaptic Plasticity and Modulates Affective Behaviors. *equal contribution. *Neuropsychopharmacology.* 2021, DOI: 10.1038/s41386-021-01041-2.

Joffe, M.E.; **Santiago, C.I.**; Oliver, K.H.; Harris, N.A.; Engers, J.L.; Lindsley, C.W.; Winder, D.G.; Conn, P.J. mGlu2 and mGlu3 Negative Allosteric Modulators Divergently Potentiate Thalamocortical Transmission and Exert Rapid Antidepressant-like Effects. *Neuron.* 2019, DOI: 10.1016/j.neuron.2019.09.044.

C. Joffe M.E.; **Santiago, C.I.**; Stansley, B.J.; Maksymetz, J.; Gogliotti, R.G.; Engers, J.L.; Nicoletti, F.; Lindsley, C.W.; Conn, P.J. Mechanisms Underlying Deficits in Prelimbic Prefrontal Cortex mGlu3/mGlu5- Dependent Plasticity and Reversal Learning Following Acute Stress. *Neuropharmacology*. 2018, DOI: 10.1016/j.neuropharm.2018.10.013.

Current Research (expanded description): The animal brain extracts salient information from its environment, generating memories and behavioral adaptations that allow it to survive a complex world. Immediate early gene transcription factors (IEG-TFs) convert transient electrical and molecular signals into long-lasting changes in function, effecting stimulus specific cellular and circuit plasticity. The IEG-TF NPAS4 is highly and specifically expressed in response to elevated neural activity and mediates input specific programs of gene expression that reorganize the spatial dynamics of synaptic inhibition. Specifically, NPAS4 driven by dendritic excitation results in a reduction in dendritic inhibition, creating a dendritic environment more conducive to plasticity, while NPAS4 driven by action potentials increases somatic inhibition, raising the threshold for future action potential output. Both dendritic and somatic NPAS4 can be driven by exposure to an enriched environment (EE), uniquely linking experience to gene expression to synaptic and circuit function.

While we have shown that NPAS4 alters CA1 PNs output in acute hippocampal slice recordings through changes in inhibition, it is not yet known how it contributes to the spatial coding that characterizes in vivo CA1 PNs, namely place cells. The primary goal of this project is to determine how NPAS4 influences in vivo firing characteristics of CA1 PNs and how this affects place cell regulation.

Benefits to Science and Society: The interplay between excitation and inhibition (E/I) is at the core of healthy brain function, dictating when a neuron will fire action potentials and what information is encoded by that neuron. Dysregulation of E/I coordination has been linked to a broad spectrum of neurological disorders including autism spectrum disorder, schizophrenia, and epilepsy. My thesis project will help bridge the gap between molecular events, where targeted therapeutic interventions can be developed, and a circuit-level understanding of hippocampal function.

Personal Interests: I love spending time in nature - playing volleyball, disc golf, surfing, or exploring our beautiful national parks.

ARCS Award: I am honored to be a recipient of the ARCS Foundation award and feel extremely supported in my scientific career goals. As a first-generation, low-income student, I deeply value the financial support from the ARCS Foundation, as it will allow me to focus more of my attention on my research. Additionally, the ARCS Foundation award has given me the opportunity to make great connections with other amazing graduate students in the UC San Diego community.

CONSUELO SAUCEDA

University of California San Diego

School of Medicine

Concentration: Biomedical Sciences

Specialization: Microbiome, Host-Microbe Interaction

Donors: The ResMed Foundation/ARCS Foundation - San Diego Chapter

Previously overlooked, the human gut has become a central focus in the study of many diseases as it holds a rich reservoir of microbes that play key roles in digestion and host immune defense. A tip in the balance of microbial abundance has been connected to many diseases, such as inflammatory bowel disease. As part of her ongoing mission, Consuelo Sauceda is focused on understanding how gut microbes contribute to disease severity in hopes of finding a targeted therapeutic. Using state-of-the-art technology, Consuelo aims to find proteins produced by gut microbes that may be leading to gut barrier dysfunction.

Degree: B.S. in Biochemistry, California State University San Marcos

Awards and Honors: UCSD's 2022 Student Inclusive Excellence Award Recipient, April 2023; Strategic Enhancement of Excellence through Diversity Fellowship Recipient, 2020-Present; Marion B. Sewer Memorial Achievement Award, 2020; UCSD's Competitive Edge Fellowship, 2020.

Publications, Papers, and Posters:

Sauceda, C.; Bayne, C.; Sudqi, K.; Gonzalez, A.; Dulai, P.S.; Knight, R.; Gonzalez, D.J.; Gonzalez, C.G. Stool Multi-omics for the Study of Host-microbe Interactions in Inflammatory Bowel Disease. *Gut Microbes.* 2022 Jan-Dec, 14 (1):2154092. DOI: 10.1080/19490976.2022.2154092.

Mills, R.H.; Dulai, P.S.; Vázquez-Baeza, Y.; **Sauceda, C**.; Daniel, N.; Gerner, R.R.; Batachari, L.E.; Malfavon, M.; Zhu, Q.; Weldon, K.; Humphrey, G.; Carrillo-Terrazas, M.; Goldasich, L.D.; Bryant, M; Raffatellu, M.; Quinn, R.A.; Gewirtz, A.T.; Chassaing, B.; Chu, H.; Sandborn, W.J.; Dorrestein, P.C.; Knight, R.; Gonzalez, D.J. Multi-omics Analyses of the Ulcerative Colitis Gut Microbiome Link Bacteroides Vulgatus Proteases with Disease Severity. *Nat Microbiol*. 2022 Feb, 7(2):262-276. DOI: 10.1038/s41564-021-01050-3.

Gonzalez, C.G.; Mills, R.H.; Zhu, Q.; **Sauceda, C.**; Knight, R.; Dulai, P.S.; Gonzalez, D.J. Location-specific Signatures of Crohn's Disease at a Multi-omics Scale. *Microbiome*. 2022 Aug 24, 10(1):133. DOI: 10.1186/s40168-022-01331-x.

Gonzalez, C.G.; Mills, R.H.; Kordahi, M.C.; Carrillo-Terrazas, M.; Secaira-Morocho, H.; Widjaja, C.E.; Tsai, M.S.; Mittal, Y.; Yee, B.A.; Vargas, F.; Weldon, K.; Gauglitz, J.M.; Delaroque, C.; **Sauceda, C.**; Rossitto, L.A.; Ackermann, G.; Humphrey, G.; Swafford, A.D.; Siegel, C.A.; Buckey Jr, J.C.; Raffals, L.E.; Sadler, C.; Lindholm, P.; Fisch, K.M.; Valaseck, M.; Suriawinata, A.; Yeo, G.W.; Ghosh, P.; Chang, J.T.; Chu, H.; Dorrestein, P.C; Zhu, Q.; Chassaing, B.; Knight, R.; Gonzalez, D.J.; Dulai, P.S. Ulcerative Colitis Host-Microbiome Response to Hyperbaric Oxygen Therapy. *Cellular and Molecular Gastroenterology and Hepatology*.14:35-53. April, 2022. DOI: 10.1016/j.jcmgh.2022.03.008

Current Research (expanded description): Inflammatory bowel disease (IBD) is a disease of the digestive tract with two common subtypes-- ulcerative colitis (UC) and Crohn's disease (CD). Epithelial injury caused by chronic inflammation is a common pathology that leads to increased risk of severe disease and morbidity. An estimated 3 million U.S. adults were diagnosed with IBD in 2015 and the disease burden continues to rise, yet no curative treatment exists. Genomic technologies have revealed that the microbiome-host interaction is largely at play in IBD, and further analyses have shown that much of the complexity to this idiopathic disease can be attributed to microbial gut composition. Our advanced multi-omics approach showed stool samples from University of California patients with severe disease activity had elevated levels of proteases derived from the colonic microbe, Bacteroides vulgatus. These observations were corroborated in vitro and in mouse models of intestinal infection. The aim of this project is to pinpoint and characterize B. vulgatus proteins that have a direct effect on the intestinal epithelium. To complete this goal, we will use advanced proteome approaches pioneered by our lab. Notably, we will study proteins of unknown function in B. vulgatus by interfacing quantitative proteomics with a newly developed human colonic cell line nanoparticle. We hypothesize that use of novel proteome-guided tools will enable the identification of proteins that target host cells linked to barrier integrity, which will open the door to alternative therapeutic avenues to combat IBD.

Benefits to Science and Society: This novel approach to study microbial proteins has the potential to elucidate key mechanisms leading to barrier dysfunction in inflammatory bowel disease. While most current treatments target inflammation and ultimately modulate symptoms, there is a great need for a direct target that can reverse disease progression and ultimately prevent it. Literature has continued to show the importance of gut microbial ecosystems for homeostasis. Holding many important metabolic roles along with aiding host immune surveillance, gut microbes show a promising potential for new therapeutic avenues that have previously been overlooked.

Personal Interests: I love spending time with friends and family. I also love to dance and teach choreography in my spare time.

ARCS Award: I am very grateful for the ARCS Foundation award and the people supporting it. This award will help alleviate the financial burden that accompanies living in such an awesome, but expensive, city. As a Latina in Science, the additional challenges on the journey through higher education due to lack of resources are greatly relieved by initiatives of organizations such as the ARCS Foundation.

ANGUS BLACKLAW THIES

University of California San Diego

Scripps Institution of Oceanography

Concentration: Marine Biology

Specialization: Physiology of Symbiosis

Donor: Carlos and Sharon Arbelaez

Angus studies the healthy physiology of corals, the animals responsible for building coral reef ecosystems. These habitats support thousands of species, provide food for millions of humans, drive global tourism, and protect coastlines from storm damage and erosion. Alarmingly, coral populations are declining rapidly due to climate change not only threatening ecological biodiversity but endangering the food supply and livelihoods of local communities. Angus' research focuses on (1) characterizing healthy coral biology (2) understanding why coral populations are declining, and (3) identifying coral species suitable for conservation efforts to rebuild degraded coral reef ecosystems.

Degrees: M.S. in Marine Biology, University of California San Diego; B.S. in Marine Biology, University of California San Diego

Awards and Honors: Best Student Research Presentation - 4th International Cassiopea Workshop 2021; National Science Foundation Graduate Research Fellowship 2019; Scripps Oceanography 1st-Year Fellowship 2019

Publications, Papers, and Posters:

Chang, W.W.; **Thies, A.B.**; Tresguerres, M.; Hu,M.Y. A. Soluble Adenylyl Cyclase Coordinates Intracellular pH Homeostasis and Biomineralization in Calcifying Cells of a Marine Animal. *Am. J. Physiol*. 2023, 324 (3), C777–C786. https://doi.org/10.1152/ajpcell.00524.2022.

Thies, A.B.; Quijada-Rodriguez, A.R.; Zhouyao, H.; Weihrauch, D.; Tresguerres, M.A Rhesus Channel in the Coral Symbiosome Membrane Suggests a Novel Mechanism to Regulate NH 3 and CO 2 Delivery to Algal Symbionts. *Sci. Adv.* 2022, 8 (10). https://doi.org/10.1126/sciadv.abm0303.

Barott, K.L.; **Thies, A.B.**; Tresguerres, M. V-Type H + -ATPase in the Symbiosome Membrane Is a Conserved Mechanism for Host Control of Photosynthesis in Anthozoan Photosymbioses. *R. Soc. Open Sci.* 2022, 9 (1). https://doi.org/10.1098/rsos.211449.

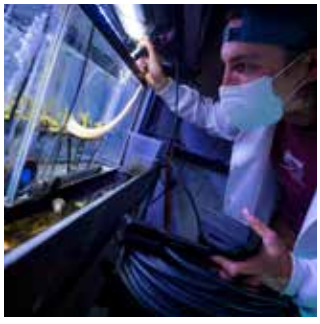
Barott, K.L.; Venn, A.A.; **Thies, A.B.**; Tambutté, S.; Tresguerres, M. Regulation of Coral Calcification by the Acid-Base Sensing Enzyme Soluble Adenylyl Cyclase. *Biochem. Biophys. Res. Commun.* 2020, 525 (3), 576–580. https://doi.org/10.1016/j.bbrc.2020.02.115.

Current Research (expanded description): My research focuses on characterizing the healthy symbiotic physiology of coral animals and their algal endosymbionts which together build coral reef ecosystems. These habitats support thousands of species, provide food for millions of humans, drive global tourism, and protect coastlines from storm damage and erosion. Alarmingly, reefs are declining rapidly due to climate change not only threatening ecological biodiversity but endangering the food supply and livelihoods of local communities. Efforts to conserve reefs have been hindered by our lack of knowledge of basic coral cell biology, a gap which I seek to close. My dissertation research has four focuses: (1) to identify the proteins responsible for nutrient-exchange in healthy coral-algal symbioses, (2) to characterize how these mechanisms compensate for normal environmental challenges, (3) to compare the physiology of healthy vs. stressed corals, and (4) to explore if these mechanisms are conserved in other animal-plant symbioses. I work with numerous photosymbiotic model systems to address these questions including corals, anemones, jellyfish, and sea slugs. So far, I have identified a novel nitrogen delivery mechanism in the coral-alga symbiosis that functions akin to the human kidney collecting duct serving as a mechanism to deliver NH3/NH4+ to algal symbionts.

Benefits to Science and Society: My fundamental research is closing the knowledge gap concerning how healthy corals function. These findings can be applied to predict the effects of climate change on coral species, design effective conservation policies, or genetically manipulate organisms for conservation or biotechnology purposes. Furthermore, fundamental research is inherently valuable as it lays the groundwork to address nuanced problems like coral bleaching. For example, sophisticated cancer treatments are only possible after a century of research established how healthy cells divide and make ATP.

Personal Interests: I love to rock climb, cook, spearfish, explore national parks, start (and maybe finish) DIY projects, and maintain close friendships.

ARCS Award: As a PhD student who conducts sparsely funded basic physiological research on a non-model organism, it can be a real challenge to address straightforward research questions and overcome experimental problems that are routine for labs working with well-characterized model systems. Receiving this award means a great deal to me: it motivates me to continue this challenging project, it reaffirms my belief that this work is important, and it makes me thankful to see that non-coral physiologists can recognize the potential of this work to mitigate ecological damage caused by humans. You have my deepest gratitude.



ALISHA ANISH UKANI

University of California San Diego

Jacobs School of Engineering

Concentration: Computer Science and Engineering

Specialization: Internet Measurement and Web Privacy

Donor: Donald C. and Elizabeth M. Dickinson Foundation

Alisha's research focuses on using Internet traffic data to improve the performance and reliability of critical infrastructure like large-scale data centers, which power vital web services in healthcare and education. She has created a method to identify network outages at Google using network availability data. Alisha plans to build and leverage large-scale measurement systems to make web service infrastructure more reliable and thus better serve the public.

Degrees: M.S. in Computer Science, University of California, San Diego; A.B. in Computer Science, Harvard University

Awards and Honors: NSF Graduate Research Fellowship 2022; UCSD CSE Award for Contributions to Diversity, 2022; Harvard University Certificate of Distinction and Excellence in Teaching, 2020; Charles J. Paine Scholarship Award 2017-2019

Publications, Papers, and Posters:

Mirian, A.; **Ukani, A**.; Foster, I.; Akiwate, G.; Halicioglu, T.; Moore, C.; Snoeren, A.C.; Voelker, G.M.; Savage, S.; Schulman, A. In the Line of Fire: Risks of DPI-triggered Data Collection. *Cyber Security Experimentation and Test Workshop*. 2023.

Randall, A.; Snyder, P.; **Ukani A.**; Snoeren, A.C.; Voelker, G.M.; Savage, S.; Schulman, A. Measuring UID Smuggling in the Wild. *Proceedings of the ACM Internet Measurement Conference*, 2022.

Ukani, A.; Mirian, A.; Snoeren, A.C. Locked-In during Lock-Down: Undergraduate Life on the Internet in a Pandemic. *Proceedings of the ACM Internet Measurement Conference*, 2021.

Current Research (expanded description): The Internet has quickly become a fundamental aspect of modern life, but we cannot truly understand its impact until we measure and analyze Internet traffic patterns from users around the world. My research analyzes network traffic and reliability data to understand 1) how to improve the performance of critical infrastructure like large--scale data centers, allowing us to make services faster and more reliable, and 2) the perspectives of users, allowing us to create better services tailored to their actual needs.

For the first goal, I completed a research internship at Google analyzing network availability data to understand and detect network outages. This analysis can help reduce the time to resolve outages, and is being incorporated into a new anomaly detection tool.

For the second goal, I analyzed how undergraduates' Internet traffic changed because of COVID-19. These results give researchers insight into a unique population.

Benefits to Science and Society: My work leverages network availability data to increase the performance and reliability of large-scale systems, which ensures that critical web applications—like healthcare, education, and banking—are always available. This work also challenges conventional wisdom and finds areas of improvement for existing networking protocols by analyzing how these protocols perform in practice.

Personal Interests: I enjoy reading fiction, interior design, and spending time with my dog. I also like to play tennis, lift weights, and play acoustic guitar.

ARCS Award: The ARCS Award has allowed me to join a strong community of scholars passionate about research in a variety of disciplines. I'm honored to be a part of this network and have it become a strong support system throughout my graduate studies.

ALICIA ANN VAN ENOO

University of California San Diego

Neurosciences Graduate Program

Concentration: Neurosciences

Specialization: Developmental Neuroscience, Stem Cell Biology

Donor: Hervey Family Fund

Alicia's research is aimed at understanding the molecular mechanisms underlying abnormal neurodevelopment in autism spectrum disorders (ASD). She uses patient-derived and CRISPR engineered stem cells to create 3-D cortical organoids, nicknamed "mini brains". By studying how these mini brains develop in a dish, Alicia hopes to gain a better understanding of what goes wrong during fetal brain development in ASD patients. These studies will provide the much-needed groundwork necessary to identify novel therapeutic targets for the potential treatment of ASD.

Degrees: M.S. in Neuroscience, University of California San Diego; B.A. in Neuroscience, minor in Public Health, Boston University

Awards and Honors: Dean's list, Boston University; Undergraduate Research Fellowship

Publications, Papers, and Posters:

Brifault, C.; Romero, H.; **Van Enoo, A.**; Pizzo, D.; Azmoon, P.; Kwon, H.; Nasamran, C.; Gonias, S. L.; Campana, W. M. Deletion of the Gene Encoding the NMDA Receptor GluN1 Subunit in Schwann Cells Causes Ultrastructural Changes in Remak Bundles and Hypersensitivity in Pain Processing. *J Neurosci.* 2020, 40 (47), 9121–9136. https://doi.org/10.1523/JNEUROSCI.0663-20.2020

Clayton, K.A.; **Van Enoo, A**.; Ikezu, T. Alzheimer's Disease: The Role of Microglia in Brain Homeostasis and Proteopathy. *Front. Neurosci.* 2017, 11. https://doi.org/10.3389/fnins.2017.00680

Ikezu, S.; Yeh, H.; Delpech, J.C.; Woodbury, M.E.; **Van Enoo, A**.; Ruan, Z.; Sivakumaran, S.; You, Y.; Holland, C.; Guillamon-Vivancos, T.; Yoshii-Kitahara, A.; Botros, M.B.; Madore, C.; Chao, P.H.; Desani, A.; Manimaran, S.; Kalavai, S.V.; Johnson, W. E.; Butovsky, O.; Medalla, M.; Luebke, J. I.; Ikezu, T. Inhibition of Colony Stimulating

Factor 1 Receptor Corrects Maternal Inflammation-Induced Microglial and Synaptic Dysfunction and Behavioral Abnormalities. *Mol Psychiatry.* 2020, 1–24. https://doi.org/10.1038/s41380-020-0671-2

You, Y.; Botros, M. B.; **Van Enoo, A**.; Bockmiller, A.; Herron, S.; Delpech, J. C.; Ikezu, T. Cre-Inducible Adeno Associated Virus-Mediated Expression of P301L Mutant Tau Causes Motor Deficits and Neuronal Degeneration in the Substantia Nigra. *Neuroscience.* 2019, 422, 65–74. https://doi.org/10.1016/j.neuroscience.2019.10.001

Current Research (expanded description): I am currently investigating how 16p11.2, the most well-known copy number variant associated with ASD, affects neural and glial development using 3-D cortical organoids and 2-D stem cell-derived astrocyte and microglial cultures. My preliminary studies suggest that cortical organoids derived from 16p11.2 patients recapitulate patient phenotypes. In the next 2 years, I will continue to comprehensively characterize 3-D cortical organoids by evaluating cell-type specific gene expression changes using single-cell RNA sequencing, changes in activity using calcium imaging and multi-electrode arrays, and glial phenotypes using immunofluorescence and functional glutamate assays. Ultimately, I hope to use this model to identify therapeutic targets and perform drug screenings.

Benefits to Science and Society: Currently, 1 in 54 children are diagnosed with an Autism Spectrum Disorder (ASD). Existing interventions are aimed at managing symptoms, as there is no cure for this disorder. Furthermore, the identification of therapeutic strategies to treat ASD has been hindered by a lack of robust experimental models to study ASD pathogenesis. The use of these 3-D "mini brains" gives us a unique opportunity to study early neurodevelopment using an in-vitro humanized model, which will allow us to identify potential new therapeutic targets and, eventually, treatments.

Personal Interests: In my free time, I enjoy going to the beach, exploring new restaurants, and snowboarding.

ARCS Award: Receiving the ARCS Foundation award is such a privilege and honor. As an "English as a Second Language" student coming from a low-income background, I've encountered numerous hurdles in my path to becoming a neuroscientist. It is thanks to incredibly generous foundations, such as the ARCS Foundation, that over the years, I have been able to continue to work towards my career goals. This funding from the ARCS Foundation allows me to focus on my research and professional development, while easing the financial burdens that come with being a graduate student. I am incredibly grateful for this opportunity.

JESSICA SHEN YI WAN

University of California San Diego

Scripps Institution of Oceanography

Concentration: Climate Sciences

Specialization: Climate Geoengineering

Donor: Laura Mateo/Lakeside Foundation

Jessica studies how climate geoengineering proposals might alleviate climate change impacts. Her research focuses on a type of geoengineering called marine cloud brightening, which cools the planet by adding sea salt particles to the lower atmosphere to form brighter marine clouds. She uses computer models of the Earth to simulate how different scenarios of marine cloud brightening could be leveraged for climate risk mitigation. As temperatures continue to rise, Jessica's research on climate geoengineering is becoming increasingly important as one proposal in the portfolio of innovative climate solutions.

Degrees: M.S. in Oceanography, University of California San Diego; B.S. in Environment and Sustainability with Distinction in Research, Cornell University

Awards and Honors: Scripps Student Symposium Outstanding Student Presenter Award, 2023; National Defense Science and Engineering Graduate Fellowship, 2022; Scripps Fellowship, 2020.

Publications, Presentations, and Posters:

Wan, J.S.; Chen, C.C.; Tilmes, S.; Luongo, M.T.; Richter, J.H.; Ricke,K. Unexpected Failure of Regional Marine Cloud Brightening in a Warmer World. *Nature Climate Change*. In review. https://doi.org/10.21203/rs.3.rs-3250111/v1.

Shah, S.H.; O'Lenick, C.R.; **Wan, J.S**.; et al. Connecting Physical and Social Science Datasets: Challenges and Pathways Forward. *Environmental Research Communications*. 2023, 5, 095007. https://doi.org/10.1088/2515-7620/acf6b4.

Ricke, K.; **Wan J.S.**; Saenger, M.; Lutsko, N.J. Hydrological Consequences of Solar Geoengineering. *Annual Review of Earth and Planetary Sciences*. 2023, 51(1). https://doi.org/10.1146/annurev-earth-031920-083456.

Wan, J.S.; Hamilton, D.S.; Mahowald, N.M. Importance of Uncertainties in the Spatial Distribution of Preindustrial Wildfires for Estimating Aerosol Radiative Forcing. *Geophysical Research Letters*. 2021, 48, e2020GL089758. https://doi.org/10.1029/2020GL089758.

Current Research (expanded description): The climate crisis has led to growing research on a set of proposals called solar geoengineering (SG), which refers to activities that increase the amount of reflected sunlight away from Earth. Marine cloud brightening (MCB) is one SG proposal that cools the planet by injecting sea salt particles into the lower atmosphere to form brighter marine clouds. While most MCB modeling studies have been designed as large-scale interventions aimed at reducing global temperatures, these experiments are not necessarily the most physically nor sociopolitically realistic, especially given the governance challenges associated with SG deployment. Thus, MCB designed for regional application and climate impact mitigation might represent a more likely scenario for future SG. My research explores the efficacy of different regional MCB schemes to mitigate local climate change impacts while avoiding unintended side effects in other parts of the world. I use a variety of tools using Earth System Models including fully-coupled global models, regional-refinement, and seasonal prediction systems to characterize the climate responses to MCB from local-to-global scales. This work is the beginning to understanding how climate system responses vary due to choices in the geoengineering strategy, background scenario, and the tools we use to model such outcomes.

Benefits to Science and Society: As climate change worsens disproportionately in parts of the world, countries may be pushed to pursue targeted climate intervention within their own geographical borders. Modeling these more geopolitically realistic scenarios of regional geoengineering is important for understanding if geoengineering can effectively provide local climate benefits while avoiding side effects in other regions. My research seeks to understand the complex local-to-global responses to different scenarios of geoengineering to inform decision-making for climate risk policy and future research.

Personal Interests: I am a professional ultimate frisbee player and college coach. I also enjoy hiking, disc golfing, baking, and painting.

ARCS Award: I am incredibly honored to be an ARCS Scholar and join this network of outstanding current and past scientists. This award will allow me to continue pushing frontiers with my research as well as pursue other interests in interdisciplinary collaborations, teaching, mentoring, and beyond.

OLIVIA JADE WENG

University of California San Diego

Jacobs School of Engineering

Concentration: Computer Science and Engineering

Specialization: Hardware-software Codesign

Donor: ARCS Foundation - San Diego Chapter

Many scientific applications require neural networks (NNs) to operate correctly in safety-critical or high radiation environments, including automated driving, space, and high energy physics. For example, physicists at the Large Hadron Collider want to deploy a model to filter their experimental data at a high data rate (~40TB/s) in a high radiation environment. Thus, the model's hardware must be both efficient and robust. However, efficiency and robustness are often in conflict with each other. Olivia's research explores this tradeoff to look for robustness in both NN hardware and software and have them work together.

Degrees: M.S. in Computer Science, University of California San Diego; B.S. in Computer Science, University of Chicago

Awards and Honors: NSF Graduate Research Fellowship Program, 2022-2025; Jacobs School of Engineering Fellowship, 2020-2022; Kunzel Powell Fellowship, 2020-2021

Publications, Presentations, and Posters:

Weng, O.; Marcano, G.; Lončar, V.; Khodamoradi, A.; Abarajithan, G.; Sheybani, N.; Meza, A.; Koushanfar, F.; Denolf, K.; Duarte, J.; Kastner, R. Tailor: Altering Skip Connections for Resource-Efficient Inference. *ACM Transactions on Reconfigurable Technology and Systems*. 2023. https://doi.org/10.1145/3624990.

Drewes, C.; **Weng, O.**; Ryan, K.; Hunter, B.; McCarty, C.; Kastner, R.; Richmond, D. Turn On, Tune In, Listen Up: Maximizing Side-Channel Recovery in Time-To-Digital Converters. 2023. https://doi.org/10.1145/3543622.3573193.

Current Research (expanded description): My research involves hardware-software codesign with respect to machine learning and specialized hardware-like field-programmable gate arrays (FPGAs). I also dabble in multi-tenant hardware security research. I describe two select projects: (1) Understanding Neural Network Resilience under Faulty Conditions: Many scientific applications require neural networks (NNs) to operate correctly in safety-critical or high radiation environments, including automated driving, space, and high energy physics. For example, physicists at the Large Hadron Collider want to deploy a model to filter their experimental data at a high data rate (~40TB/s) in a high radiation environment. Thus, the model's hardware must be both efficient and robust. However, efficiency and robustness are often in conflict with each other. To address these opposing demands, we present FKeras, an open-source tool that measures the fault tolerance of NNs at the bit level to better understand this efficiency and robustness tradeoff. (2) Deep neural networks employ skip connections—identity functions that combine the outputs of different layers—to improve training convergence; however, these skip connections are costly to implement in hardware because they consume valuable resources. For certain classification tasks though, a network's skip connections are needed for the network to learn but not necessary for inference after convergence. We introduce Tailor, a fine-tuning/retraining method that alters skip connections in a fully trained network to reduce their hardware cost.

Benefits to Science and Society: By making neural networks more hardware-efficient, my research makes it possible to deploy models when it was formerly too expensive. This is impactful because it allows machine learning (ML) to be deployed in parts of the world that only have access to inexpensive hardware. ML models are being used more and more in areas such as physics, self-driving cars, and IoT (Internet of Things), all of which need to run networks in constrained environments. In fact, my work will empower researchers from any discipline that requires deploying ML models under these extreme conditions.

Personal Interests: I regularly attend the theater.

ARCS Award: I am very honored to receive the ARCS Foundation award. It means a lot to me that my research is recognized in this way at such an early stage my career. It encourages me to continue to pursue my ambitions.


University
of San Diego

ANDREA MARIE CORREIA

University of San Diego

Hahn School of Nursing and Health Science

Concentration: Nursing

Specialization: Pediatrics

Donor: Beyster Family Foundation

Healthcare-related workplace violence perpetrated by patients and caregivers has steadily increased. Numerous studies have been conducted to understand the prevalence and cause. However, fewer studies have been done within the realm of pediatrics. Andrea plans to explore factors contributing to workplace violence in pediatric settings. Such an understanding can eventually lead to improved preventative measures for pediatric healthcare organizations.

Degrees: M.S.N. in Nursing, Western University of Health Sciences; B.S. in Athletic Training, Chapman University

Awards and Honors: University of San Diego, Dean's Merit Scholarship, 2022; Children's Health Orange County President's Recognition Award, 2021; Society of Pediatric Nurses, Excellence in Education Award, 2021; Children's Health Orange County, Daisy Nurse Leader Award, 2019.

Publications, Papers, and Posters:

Anderson, B.; Birkinshaw, H.; **Correia, A.**; Park, S. Addressing Non-iatrogenic Withdrawal in a Pediatric Inpatient Setting. Poster. *32nd Annual Society of Pediatric Nurses (SPN) Conference*. Anaheim, CA, April 2022.

Barrows, J.; Birkinshaw, H.; **Correia, A.** Standardization of Initiation and Weaning of High-flow Nasal Cannula (HFNC) Therapy in a Pediatric Hospital. Poster. *32nd Annual SPN Conference*. Anaheim, CA, April 2022.

Birkinshaw, H.; **Correia A.** Providing Education and Support in Uncertain Times. *31st Annual SPN Conference.* Virtual, April 2021.

Bigani, D.; **Correia, A.** On the Same Page: Nurse, Patient, and Family Perceptions of Change-of-shift Bedside Report. *Journal of Pediatric Nursing.* 2018, 41, 84–89.

Current Research (expanded description): Healthcare-related workplace violence perpetrated by patients and families has steadily increased, impacting all healthcare professionals, especially nurses. Several studies on healthcare-related workplace violence within the adult population have been conducted. In contrast, there are fewer studies on healthcare-related workplace violence in pediatrics. The purpose my proposed research is to describe nurses' perceptions of what contributes to workplace violence exhibited by patients and families in a pediatric setting.

Benefits to Science and Society: One expected benefit of my proposed research is identifying potential factors contributing to healthcare-related workplace violence within a pediatric setting. Such knowledge can improve a healthcare organization's ability to understand, identify, and respond to incidents of workplace violence. Furthermore, it can aid in implementing practices and policies that can ultimately aid in reducing incidents of workplace violence.

Personal Interests: My interests include reading, traveling, and spending time with family and friends.

ARCS Award: It is a true honor to receive the ARCS Foundation award. This award will help me reach my goal of becoming a nurse scientist. Furthermore, this award will allow me to make an impact on the lives of patients, families, and nurses who have been affected by workplace violence.

OLIVER MALLILLIN ERECE

University of San Diego

Hahn School of Nursing and Health Science

Concentration: Nursing

Specialization: Surgical & Medical Oncology

Donor: Beyster Family Foundation

Oliver is investigating the efficacy of the Critical Care Pain Observation Tool (CPOT) for assessing pain in nonverbal patients outside ICU settings. This follows the retirement of the Checklist of Non-observable Pain Indicators (CNPI) in Oliver's organization, in line with The Joint Commission's recommendations. The research seeks to fill a gap in understanding whether CPOT can effectively prompt interventions for pain management in nonverbal patients, particularly those with conditions like dementia. Although CPOT is widely used in critical care settings for intubated or sedated patients, its effectiveness in guiding interventions for nonverbal patients in different hospital settings is the focal point of Oliver's study.

Degrees: M.S. in Nursing, University of San Diego; B.S. in Nursing, San Diego State University

Awards and Honors: Nurse of Year, 2021; Clinical Nurse Advancement, 2019; Embrace Community Service Award, 2018

Current Research (expanded description): I intend to investigate the effectiveness of the Critical Care Pain Observation Tool (CPOT) as a behavioral pain assessment instrument for nonverbal patients in non-ICU settings. Recently, the CPOT has been extended to populations outside the ICU, such as patients with dementia and severe intellectual disabilities who cannot verbally communicate their pain. My organization retired the other instrument, the Checklist of Nonobservable Pain Indicators (CNPI), to align with the The Joint Commission's recommendations of reducing the number of instruments to prevent confusion for nurses. There is a research gap concerning whether CPOT effectively triggers intervention when indicating the presence of pain in these nonverbal patients. The CPOT has been widely used in critical care settings to assess pain in intubated or sedated patients, a very different population. My working research question: Is CPOT as effective as CNPI in guiding nurses to intervene and provide appropriate pain management for hospitalized nonverbal patients?

Benefits to Science and Society: This research would benefit science by advancing the understanding of healthcare assessment instruments. It has the potential to enhance patient care by improving pain assessment and management, particularly for individuals with conditions like severe cognitive disability. This research may lead to more efficient healthcare practices and align with regulatory standards, ultimately reducing suffering and contributing to improved patient outcomes. Additionally, it can bolster nursing by providing evidence-based instruments, benefiting both the scientific community and society at large through enhanced healthcare quality and patient comfort.

Personal Interests: I am passionate about artistic expression through drawing and video editing. I am devoted to mentoring novice nurses for their growth and success.

ARCS Award: The ARCS Foundation award is a great honor to receive. I come from a small island, Guam, and having grown up in a challenging neighborhood, I never imagined I would reach this point. This scholarship represents a significant milestone, reflecting my resilience and dedication. It reinforces my belief that, with determination and education, one can overcome obstacles and achieve one's dreams. I'm truly grateful for this opportunity and excited about the journey ahead.

JENNIE MIKO LEE

University of San Diego

Hahn School of Nursing and Health Science

Concentration: Nursing

Specialization: Maternal Health Disparities

Donor: Beyster Family Foundation

Jennie's research is aimed at improving maternal outcomes with reduced rates of morbidity and mortality due to maternal hemorrhage, the leading cause of maternal morbidity. Her research project is focused on disadvantaged people, exploring the relationship between social determinants of health and maternal mortality by investigating social and economic variables of access to healthcare and health disparities that correlate with maternal mortality.

Degrees: M.B.A. in Healthcare Management, Western Governors University, M.S. in Nurse Anesthesiology, University of Southern California, B.S. in Nursing, University of Southern California.

Awards and Honors: Doris A. Howell Foundation for Women's Research Award 2023; Irene S. Palmer Research Award 2023; Neely Warren Foundation Award 2023; University of San Diego, Dean's Merit Scholarship Award 2022-2023

Current Research (expanded description): There is an increasing trend in the number of reported pregnancy-related deaths in the U.S. with a reported 4 in 5 pregnancy-related deaths being preventable. One of the leading underlying causes of pregnancy-related death is obstetric hemorrhage. The purpose of my research is to identify prevention opportunities, and decrease health inequities to improve maternal health outcomes. The objectives of my research are to examine socio-economic health disparities and their relationship to maternal mortality to improve maternal health outcomes and to identify factors that increase the odds for survival.

Prevention science and early intervention with populations experiencing health disparities, with an overall aim to evoke individual, family, community, and social change, is the major goal of my research and clinical practice. I have a broad background in nursing, specifically nurse anesthesiology, with obstetric anesthesia management being the heart of my clinical practice and research interest.

Benefits to Science and Society: My research will use international data to generate supportive evidence to reduce maternal mortality from hemorrhage by identifying factors that can be used for early detection and appropriate management of maternal complications. My research will help identify sub-populations of women at greater risk for obstetric hemorrhage and address the care inequalities they experience. Overall, the expected benefits of my research are the improvement of maternal healthcare outcomes and decreased mortality of disadvantaged people.

Personal Interests: I enjoy spending time with family, training jiu-jitsu, bodyboarding, running, playing guitar and fishing in Alaska and the Eastern Sierras.

ARCS Award: It is a great honor to have been selected as an ARCS Scholar. As a first-generation college graduate, I have tremendous gratitude for the ARCS Foundation's financial support and recognition. This award encourages me to continue my PhD journey to generate, synthesize, and advance nursing science. I am grateful to join a vibrant and inspiring community of likeminded Scholars and mentors that are collectively working toward scientific achievement.

TINA CONNIE SMITH

University of San Diego

Hahn School of Nursing and Health Science

Concentration: Nursing

Specialization: Pediatrics

Donors: Laurie and Michael Roeder/ARCS Foundation - San Diego Chapter

As the literacy gap between healthcare workers and patients grows, nurses must help provide healthcare information realistically. For this reason, Tina's research is focused on the health literacy of parents of acutely sick children so that she can start to tackle the difficulties of the health literacy gap. Her entire bedside career has been dedicated to one of the most vulnerable populations, pediatric patients, and by increasing parents' and caregivers' health literacy she aims to improve the lives of her patients, both current and future.

Degrees: M.S. in Executive Nursing Leadership, University of San Diego; B.S. in Nursing, Loyola University Chicago

Awards and Honors: Dean's Graduate Merit Scholar, University of San Diego, 2021, 2022, 2023

Current Research (expanded description): As a bedside nurse I have seen the growing gap between healthcare providers' health literacy and parents or caregivers of pediatric patients. Many parents are intimidated by morning rounds and do not feel comfortable admitting that they do not understand their child's diagnosis, surgical plan, or medications. I decided to tackle this topic in hopes of increasing parents' health literacy, and by extension, improving the health of my patients. Current literature shows that when parents understand the information that is given to them, verbal or written, the readmission rate for their children decreases. My hope is that I can find a correlation between health literacy, stress, and social determinants of health and can start to make a positive impact on the inpatient environment to increase parents' health literacy.

Benefits and Science and Society: The purpose of this research is to prove that stress has an effect on the health literacy of parents, in hopes of starting to change when and how information is presented. If the environment can change in a positive way, the learner's understanding of healthcare will improve, and the health of their child will benefit. The goal is to implement a new plan to help parents learn, instead of expecting them to understand medical information during difficult times.

Personal Interests: I enjoy traveling, baking, and finding new restaurants. I am also a huge sports fan. The Los Angeles Angels are my favorite team.

ARCS Award: The generous ARCS Foundation Award allows me to dedicate more time to my research because it reduces the financial burden of academics. It is also a reminder that the scientific community supports its newest researchers and believes that they can succeed. At the end of my PhD journey, I hope to prove just that, and ARCS will have played an important role.

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